Excentro

Guilloche Design Generator for Macintosh

USING EXCENTRO

EXCOURSE

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USING EXCENTRO

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CONTENTS

About Using Excentro Guide i-1

PART I: INTRODUCTION TO EXCENTRO

Chapter 1: Introductory Tutorial 1-1

Chapter Summary 1-14

Chapter 2: Basic Conceptions 2-1

Historical Background 2-1

Excentro Model 2-2

Structure and Bases 2-2

Direction 2-4

Content Elements 2-6

Chapter Summary 2-7

Chapter 3: User Interface Tour 3-1

Document Windows 3-1

Inspectors 3-3

Swatch Palettes 3-5

Toolbar 3-5

Usage Tips 3-6

Chapter 4: Structure of Guilloche Design 4-1

Anatomy of Guilloche Design 4-2

Bases 4-4

Regular Elements 4-6

Content Elements 4-8

Step & Repeat Sets 4-11

Modifying Guilloche Design Structure 4-13

Direction 4-14

PART II: EXCENTRO TUTORIALS

Chapter 1: Creating Documents With Guilloche Designs 1-1

Concept Creation 1-1

Document Design and Composition in Excentro 1-3

Additional Steps With Adobe Illustrator 1-12

Chapter 2: Linear Backgrounds 2-1

Case Study 2-1

Step by Step Background Creation 2-2

Template and Examples 2-7

Making It More Complicated 2-12

Chapter 3: Blended Backgrounds 3-1

Case Study 3-1

Step by Step Background Creation 3-3

Template and Examples 3-11

Chapter 4: Radial Backgrounds 4-1

Case Study 4-1

Step by Step Background Creation 4-3

Template and Examples 4-9

Central Problem 4-15

Chapter 5: Circular Backgrounds 5-1

Case Study 5-1

Step by Step Background Creation 5-2

Template and Examples 5-8

Chapter 6: Rosettes 6-1

Case Study 6-1

Step by Step Rosette Creation 6-3

Template and Examples 6-17

Chapter 7: Borders 7-1

Case Study 7-1

Step by Step Border Creation 7-2

Template and Examples 7-10

ABOUT USING EXCENTRO GUIDE

Using Excentro guide contains introductory material, tutorials and practical tips you can find helpful while learning and using *Excentro* application. It is devised to be used in conjunction with accompanying reference books: **Excentro Commands Reference**, **Excentro Objects Reference** and **Excentro Windows Reference**.

This book does not provide detailed references of user interface elements or descriptions of *Excentro* objects and their attributes. When you need to look up any of these you can find it in one of reference books mentioned above. **Using Excentro** guide is designed for novice users who did not have a practical experience with *Excentro* before, so they could find some introductions, basic conceptions explanations, instructions and tutorials here.

The book is organized in the following way:

- **Part 1: Introduction to Excentro.** This part of the book starts with small tutorial that you can follow to get acquainted with user interface of *Excentro* application. After that you will find chapters with brief descriptions of all important stuff: explanations of basic conceptions and mechanical model of *Excentro* application, introduction to windows and controls of *Excentro* user interface, notes on tree-like structure of guilloche designs and its various elements.
- **Part 2: Excentro Tutorials.** This part of the book contains tutorials and practical advises you can use while working on guilloche designs of specific types (like backgrounds, rosettes or borders). These tutorials cover almost every possible design type as well as the matters of assembling a complex document from several parts with different designs.

Type conventions used in this book are the same as in other books of *Excentro* reference set:

Bold type style is used to expose titles of windows, dialogs, menu commands and other interface elements like controls and buttons. It also is used for titles of other chapters and books of *Excentro* guides.

Italic type style is used for names of applications, software products and names of companies that produce them. This style is also used to show sample numeric and string values you can enter in fields of dialogs.

Sometimes you will encounter **Comments** at the end of sections and chapters. You can skip these, since they do not contain information of practical value. But you may find them interesting to look at if you have a spare minute.

Whenever possible we use *Mac OS 9* versions of screenshots for illustrations. There are two main reasons for us to do so:

1. Most of those who use *Mac OS X* used *Mac OS 9* not so long before it, so they are also accustomed to older windows and menus look, unlike those who still use *Mac OS 9*. Those who can not use *Mac OS X* for some reasons can be easily confused by new *Aqua* appearance, so we minimized use of new windows and menus where we could.

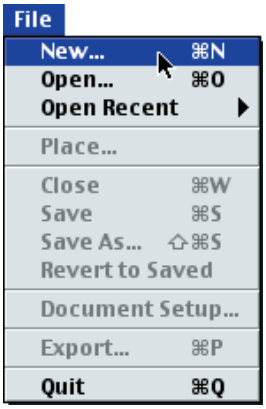
2. Antialiased text and transparent windows with striped background are pretty cool features on computer screen. However older screenshots still look better when printed on paper and produce smaller size PDF format documents.

PART I: INTRODUCTION TO EXCENTRO

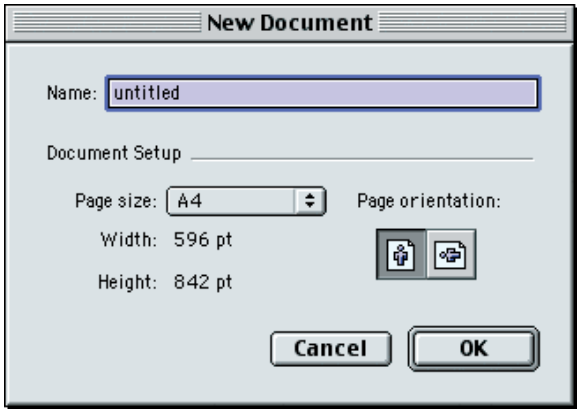
CHAPTER 1: INTRODUCTORY TUTORIAL

This first chapter of **Using Excentro** guide serves as an introduction to help new users to get acquainted with *Excentro* application interface, look and feel. You are not required to know anything about *Excentro* at this point or understand what exactly is going on. All you should do is to perform actions with commands and windows and see results on the screen. Each step in the action sequence has summary of tasks it introduces and comments in *italic* that you can skip on first reading.

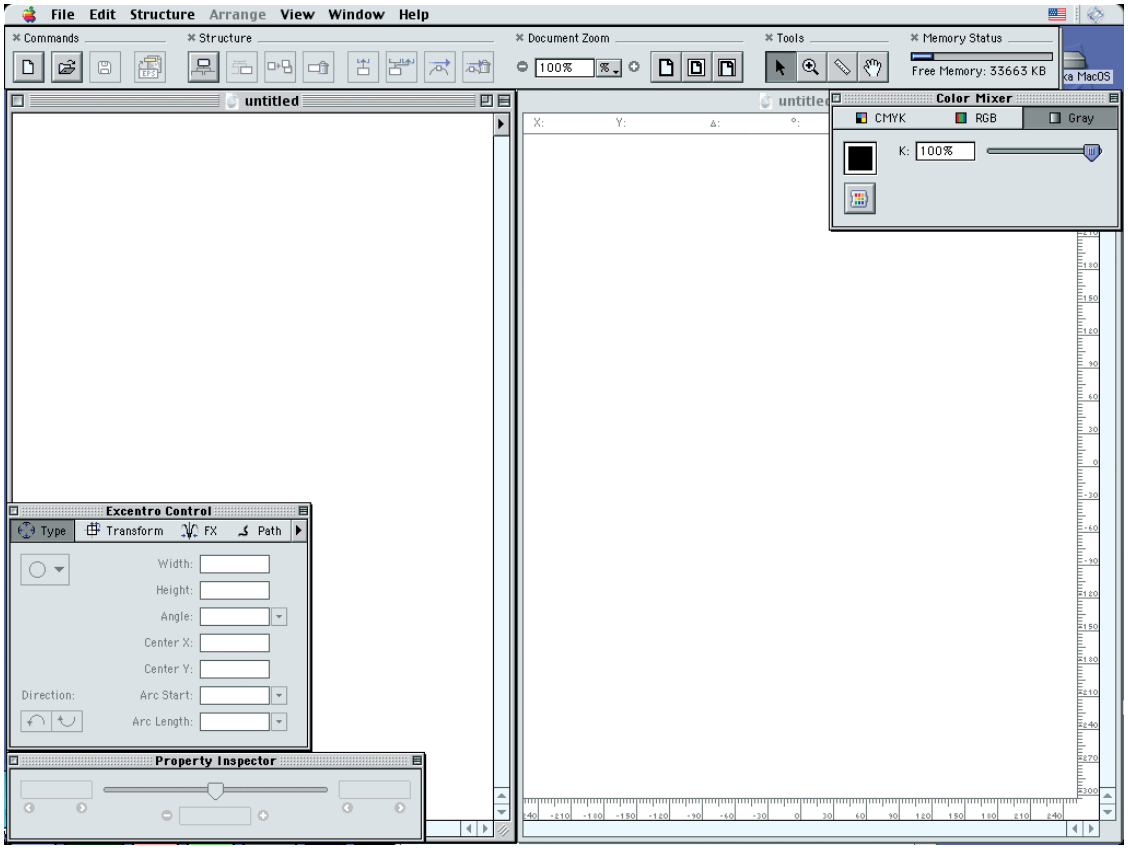
■ **Step 1.** Launch *Excentro* application by double clicking its icon in *MacOS Finder* window. When application start up procedure is over and splash screen disappears, choose **New** command from **File** menu.



■ **Step 2.** You will see dialog window that prompts you to enter name for new document, specify page size and orientation. For this tutorial purpose leave all fields of dialog as it is or select '*Letter*' from **Page Size** pop-up menu if it is more natural page format for you. Click **OK** button.



Two blank windows will open at once on screen before you (see picture on next page). Both windows belong to a single new *Excentro* document. Left window is called **main document window**, it will be used to show document content in internal to *Excentro* way as a structure of interconnected elements. Right window (one with rulers and **<view>** suffix in title bar) is called **document preview window**, it will be used to show same document content as graphics. Actions in the second window are limited to scrolling, zooming and objects selection.

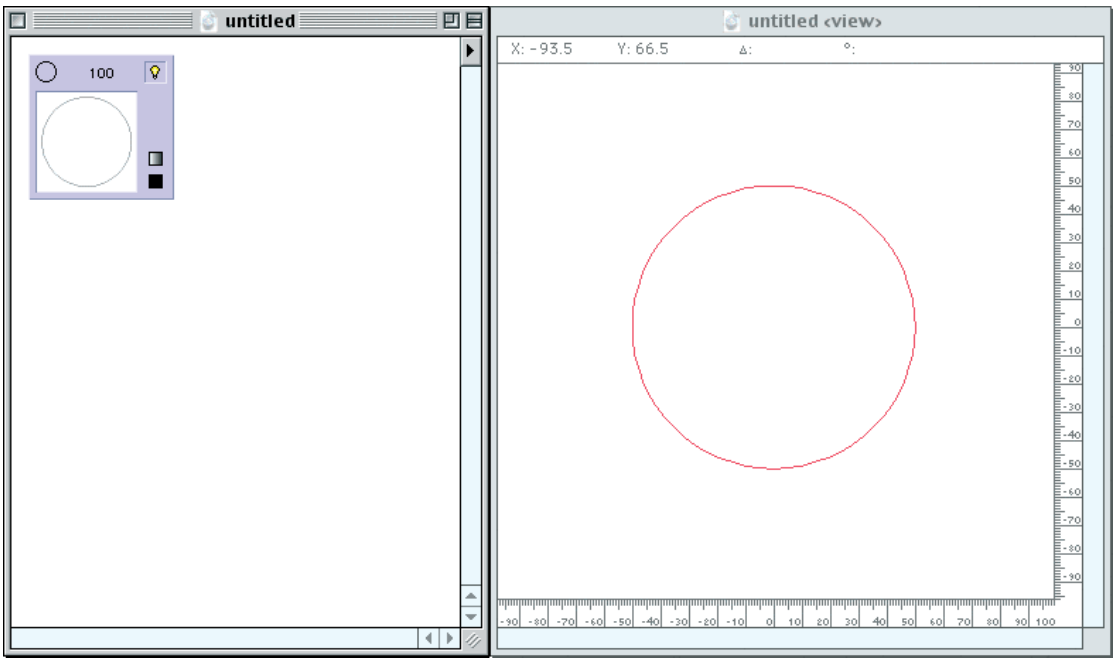


Summary: From the two first steps you should learn that making new document in *Excentro* is not different from any other *Macintosh* application and is performed with **New** command from **File** menu. Unlike documents of other applications, *Excentro* document has two windows that show same document content in two different ways. If you have more than one document opened, selecting one of the windows that belong to the document in background will bring to front second window of this document as well. Closing main document window will close both: **main document window** and **document preview window** of this document.

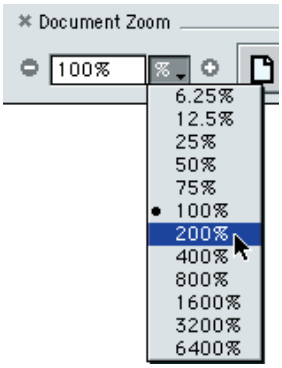
Comments: *Document page size you where asked for in **New Document** dialog is provided to visually limit work area and simplify objects positioning. You can always change it with **Document Setup** command at later time. Entries of **Page Size** pop-up menu could be edited in **Excentro Preferences** dialog to include non-standard sizes of documents you work with often. Default page sizes include common page formats and standard ISO sizes for plastic cards.*

■ **Step 3.** Choose **New Base** command from **Structure** menu. This is the only command of **Structure** menu that is available to you at this moment.

A rectangular picture with small icons will appear in top left corner of the main document window and circle 100 points wide will be drawn in central part of the document preview window:



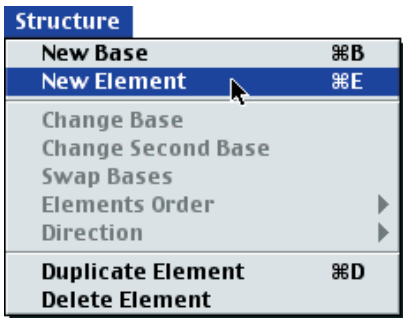
If you work with monitor at high resolution, you may want to select '*200%*' or larger magnification values from **Document Zoom** pop-up menu of **Toolbar** to allow for better display in the document preview window:



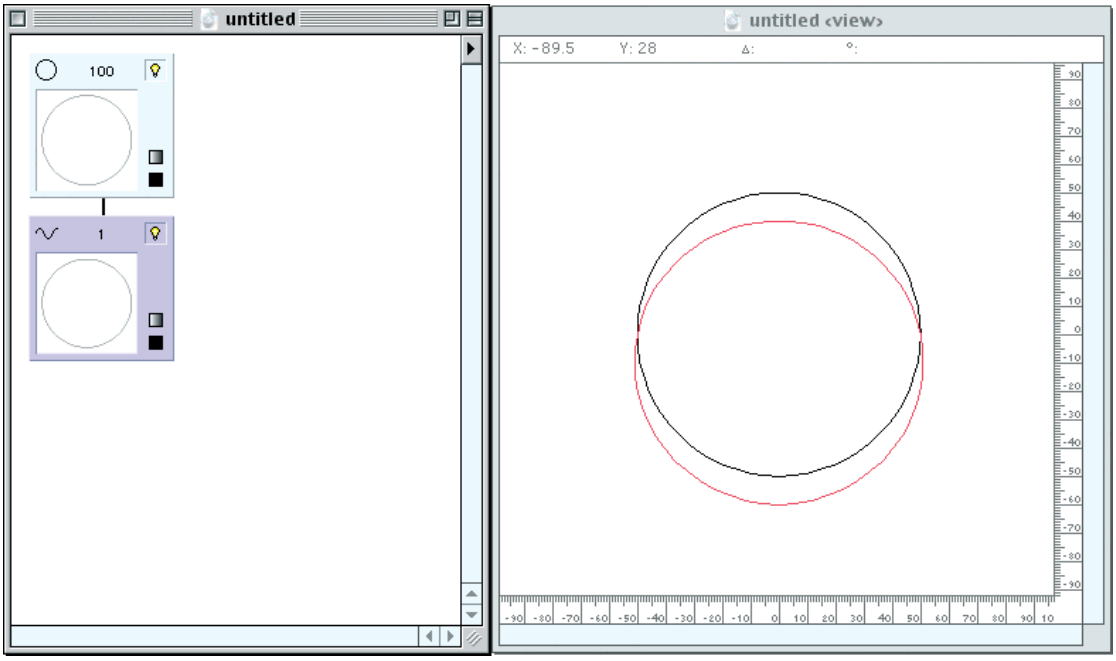
Summary: Creation of new guilloche design in *Excentro* starts with creation of the first basic shape with **New Base** command from **Structure** menu. Default basic shape is the circle 100 points wide.

Comments: *Basic shapes (created with **New Base** command) are called '**base objects**', '**base elements** ' or simply '**bases**'. They define type of the future guilloche design. For circular designs like rosettes or circular backgrounds you should use bases of **Ellipse** type (the circle above is a base of **Ellipse** type with both **Width** and **Height** attributes equal '100 pt'). For bands, borders and linear backgrounds you should use bases of **Line** type. For frames you can use bases of **Rectangle** type. There are also bases of **Spiral** type that could be used in some special spiral-like designs.*

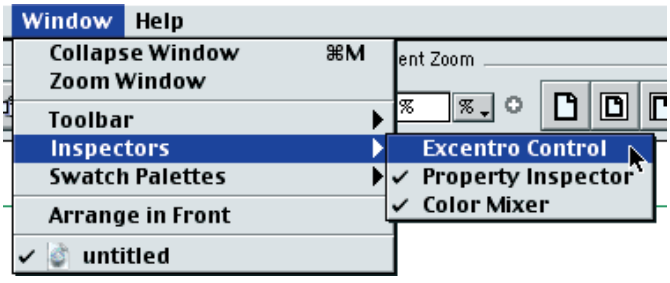
■ **Step 4.** After the first base object was created (and this base is the selected object in the main document window) **New Element** command becomes active in **Structure** menu. Choose this command:



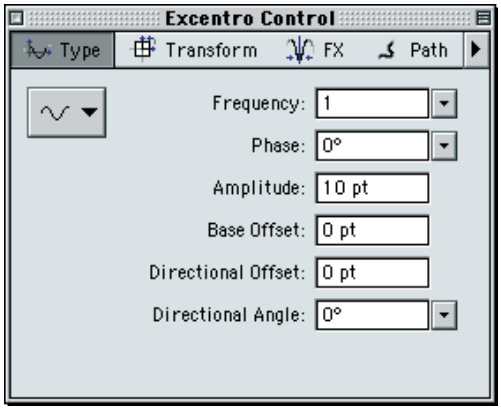
New rectangular picture with small icons will appear in the main document window below the rectangle of the base object and another shape will be drawn in the document preview window.



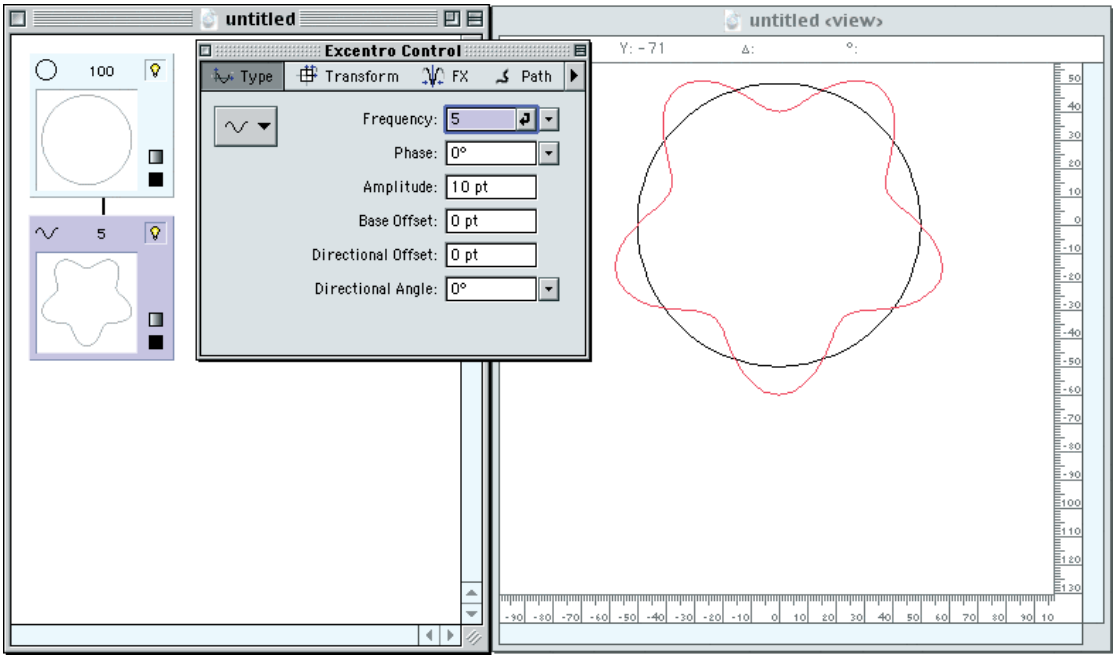
■ **Step 5.** Now let us take a look at **Excentro Control** inspector. It is a floating window that initially is located in bottom part of the screen. If it is not visible, double click newly created rectangle in the main document window or choose **Excentro Control** command from **Inspectors** submenu of **Window** menu:



Excentro Control inspector shows all attributes of objects in *Excentro* documents and allows user to modify them. It is a main focus of all user actions.



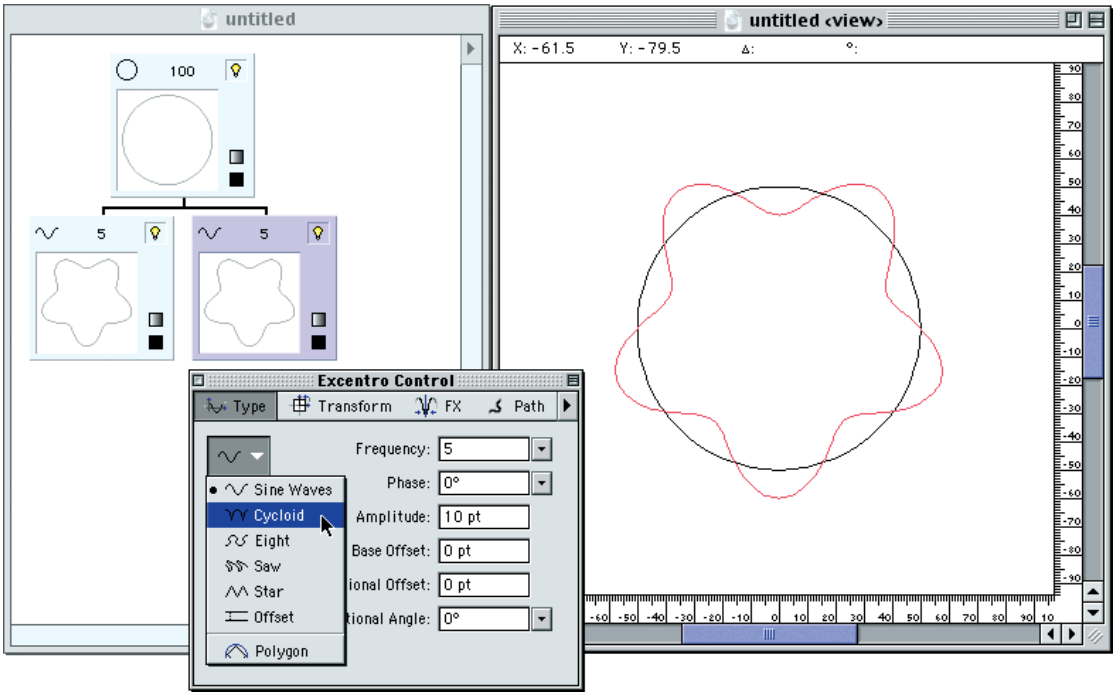
Enter '*5*' in **Frequency** attribute field and press return key or select '*5*' from pop-up menu to the right of this attribute field. Rectangular picture in main window and path shape in the document preview window will be updated to reflect new attribute value.



Summary: New objects in *Excentro* documents (except for first basic shapes) are created with **New Element** command from **Structure** menu. Attributes of objects could be modified with **Excentro Control** inspector.

■ **Step 6.** To create additional objects you can either use **New Element** command again or make a copy of existing objects with **Duplicate Element** command. Choose **Duplicate Element** from **Structure** menu.

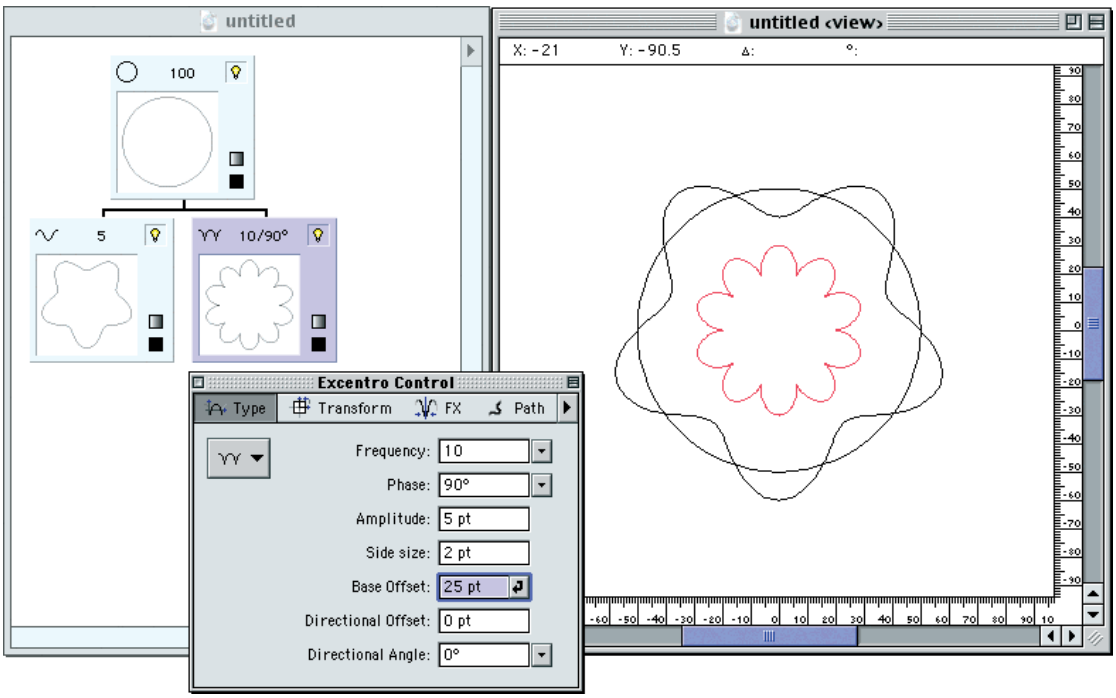
Another rectangle will appear in the second row of main document window. It will be identical to the rectangle we created in previous step. Position of the top rectangle (base object with circle shape) will be adjusted, so it will be located between both rectangles in the second row.



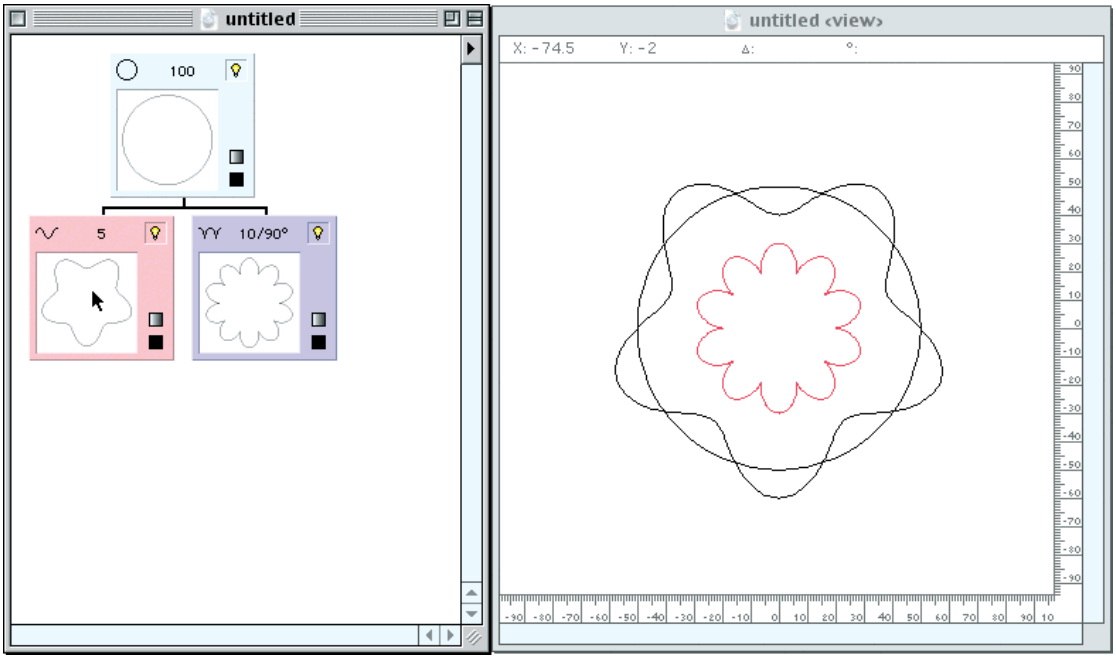
■ **Step 7.** In **Excentro Control** inspector select '*Cycloid*' from **Type** pop-up menu (see picture above). Enter new attribute values:

Frequency = '*10*', **Phase** = '*90°*', **Amplitude** = '*5 pt*', **Side Size** = '*2 pt*', **Base Offset** = '*25 pt*'

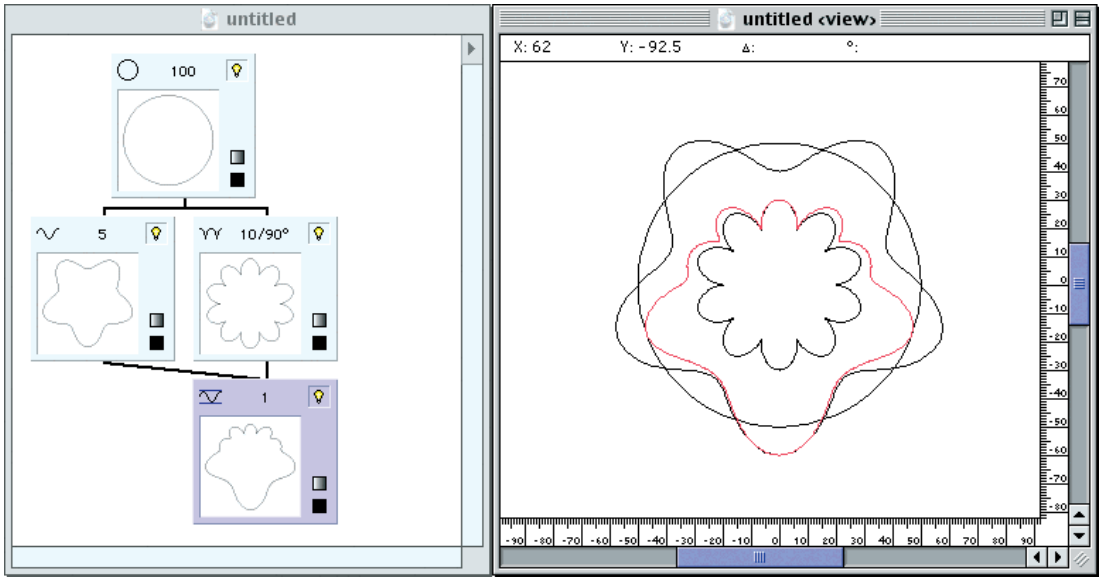
The rectangle in main window and its path in preview window will change accordingly.



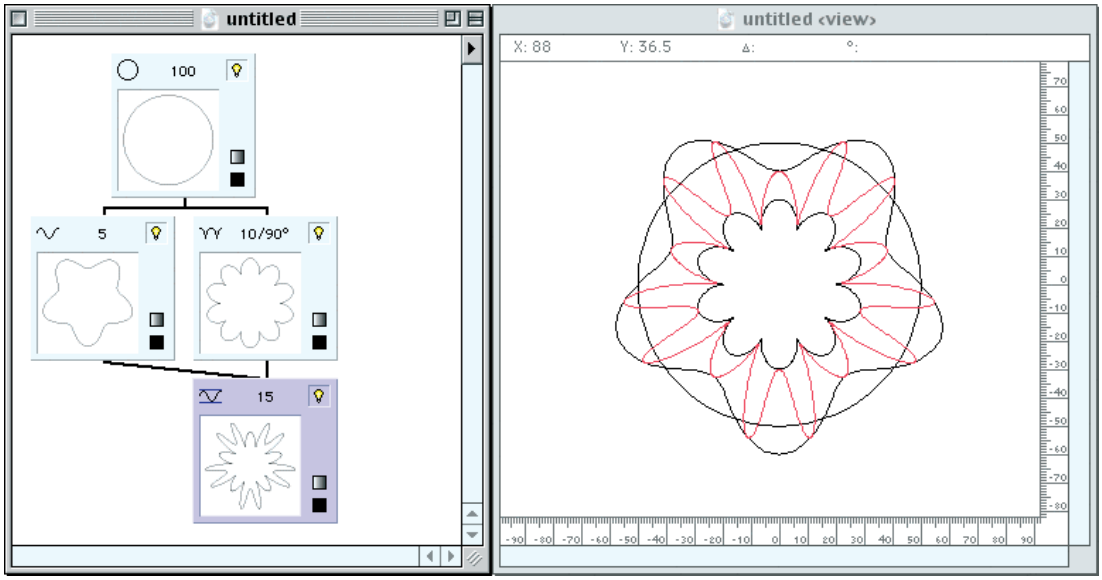
■ **Step 8.** Hold down **Shift** key and click object's rectangle we created in **Step 4**. Its color will become reddish. (Do not deselect the object created in **Step 7**, if it is not selected click its rectangle to select, before selecting the second object.) Choose **New Element** command from **Structure** menu again.



New rectangle will appear in the main document window with black connection lines to both rectangles that were selected above. New path in the document preview window will appear between two paths that belong to parent objects of this new object.



■ **Step 9.** Enter '15' in **Frequency** field of **Excentro Control** inspector and press return key (or select 15 from pop-up menu to the right of the **Frequency** field). Rectangle picture in the main window and shape in the right window will change to reflect new attribute value.

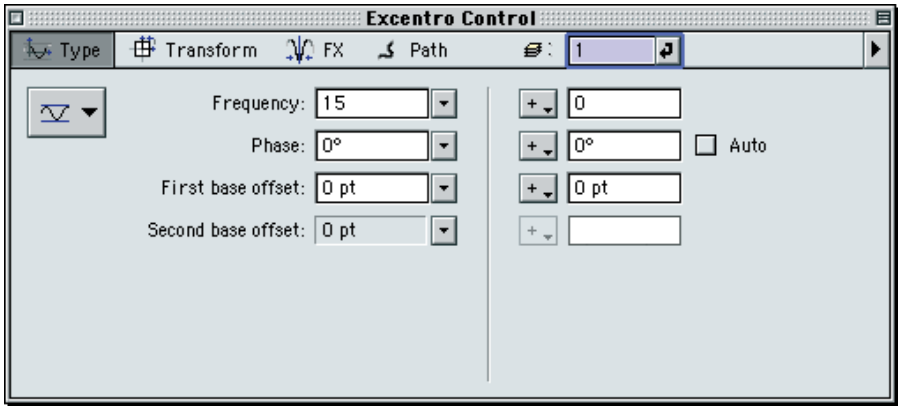


Summary: In *Excentro* you can create object with path located between paths of two other objects. To do so you should select the first object with mouse click, the second object with **Shift**-click and choose **New Element** from **Structure** menu.

Comments: *These objects are called* ***content elements.*** *Two parent objects are called* ***base*** *of this content element and* ***second base*** *of this content element respectively.*

■ **Step 10.** Click button with triangle in top right corner of **Excentro Control** window and choose **Add Step & Repeat Set** command from the pop-up menu.

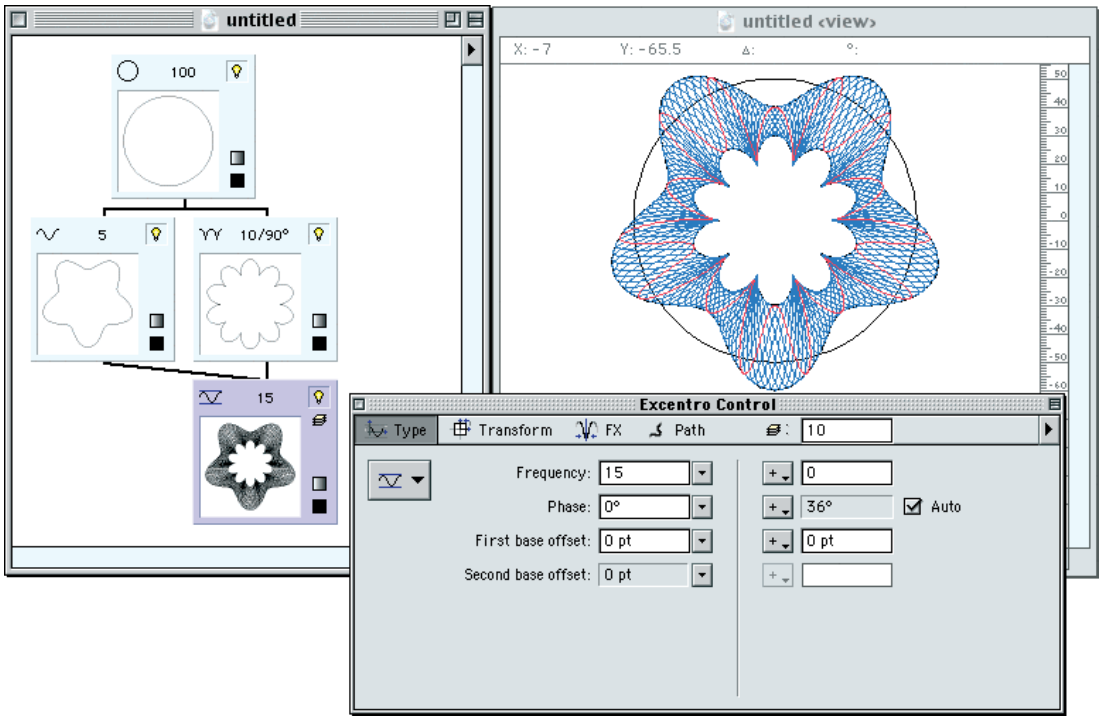
Excentro Control window will expand to accommodate new fields:



Enter '*10*' in **Numbers of Steps** field on top (it has 'pile' icon in front of it) and click **Auto** checkbox on the same line as **Phase** attribute field. **Increment** field beside checkbox will become non-editable and its value will be automatically set to '*36°*'.

Document windows will change display to reflect the latest development.

In the document preview window additional 9 paths will be created to uniformly fill the space between two paths that belong to parent objects of the selected object. 'Main' path of the object will be still shown with red selection color, new additional paths will be shown with blue color.

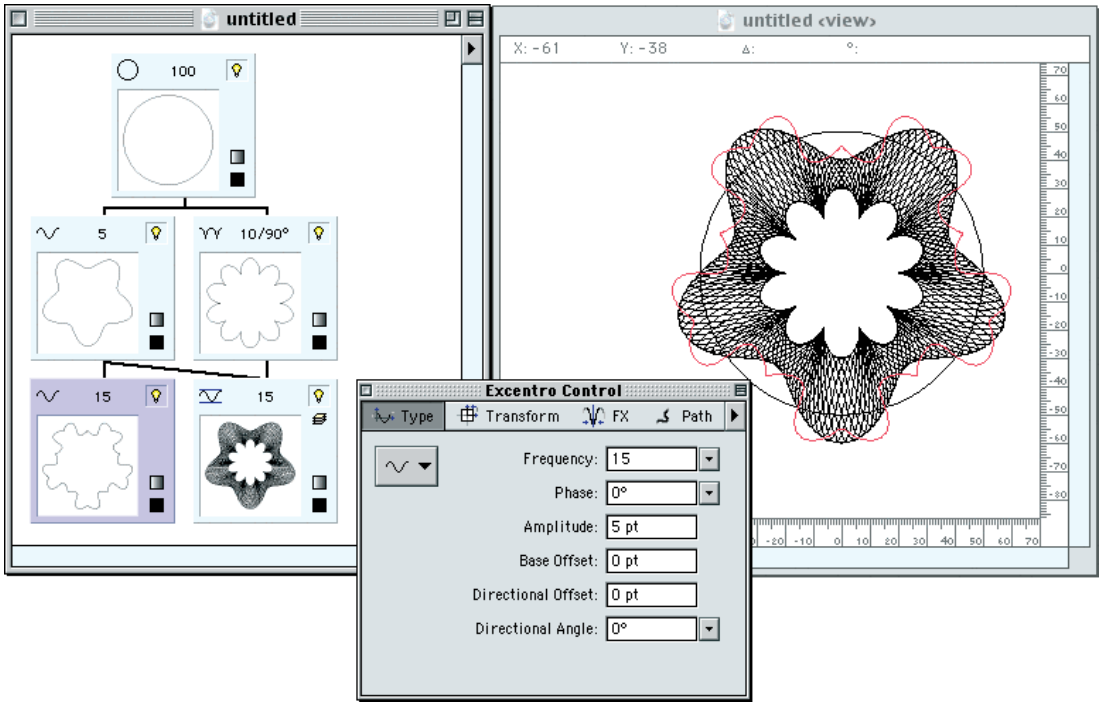


Summary: Every object in *Excentro* document may have Step & Repeat Set that produce additional paths. These paths are created by modifying one or more object attributes with specified increment values. Step & Repeat Set are created with **Add Step & Repeat Set** command from **Excentro Control** window pop-up menu.

Comments: *The object may have more than one Step & Repeat Set added to it. In this case number of paths produced by all Step & Repeat Sets equal to multiplication of number of steps values of every Step & Repeat Set this object has. Multiple Step & Repeat Sets are usually used for backgrounds creation: you can create complete complex background by using a single object with several Step & Repeat Sets.*

■ **Step 11.** Click object we created in **Step 4** (the left object in the second row) to select it. Choose **New Element** command from **Structure** menu to create new object that will be added below this selected object on the third row of the document's structure.

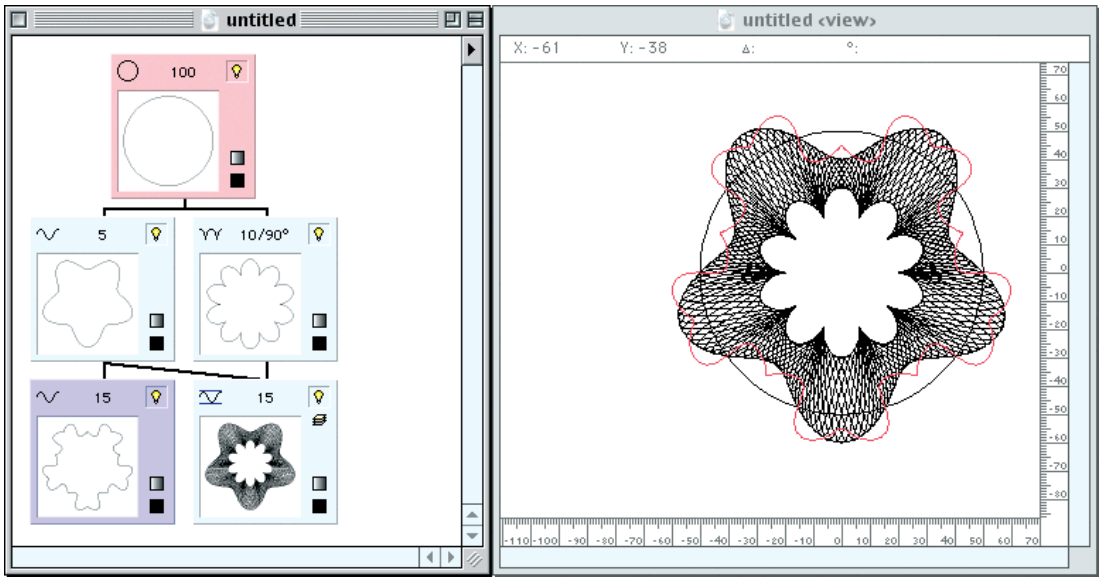
■ **Step 12.** In **Excentro Control** window enter: **Frequency** = '*15*', **Amplitude** = '*5 pt*'. Document windows will be updated as shown on next page.



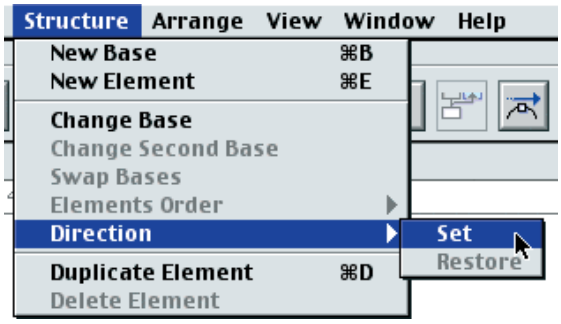
Summary: You can create new objects that use any other existing objects as their parents (in other words: any existing object can become a parent object for new objects). To create new object you should select existing object with mouse click and choose **New Element** command from **Structure** menu. The new objects will appear below their parent objects in the document's structure tree.

Comments: *The parent object is also called* ***base*** *of the new object. Just like with content elements from* ***Step 9****, whose two parent objects are called* ***base*** *and* ***second base****.*

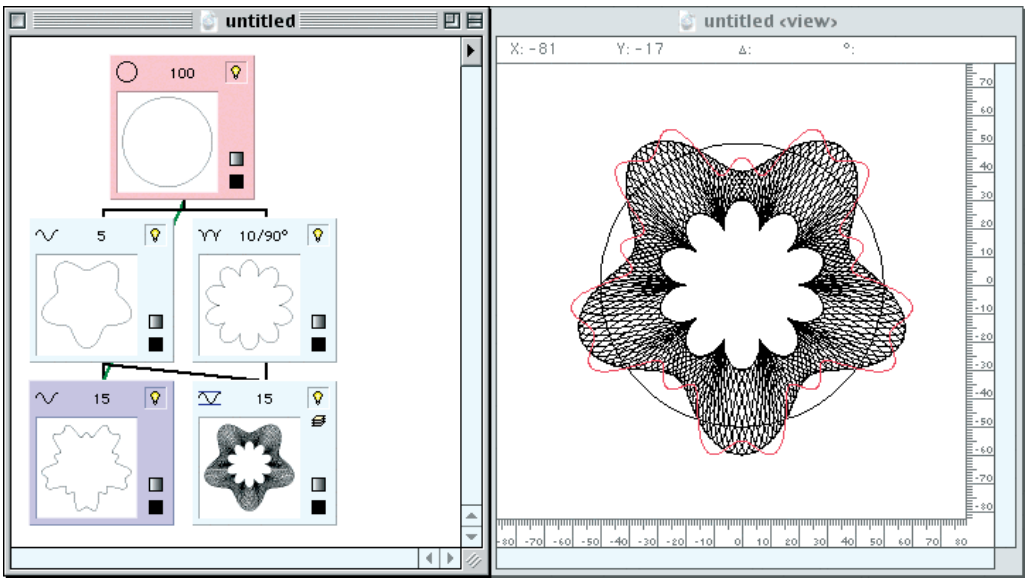
■ **Step 13.** Hold down **Shift** key on the keyboard and click with mouse pointer the first base object we created (the rectangle with circle on top of the structure tree). The color of its rectangle will become reddish.



Choose **Set** command from **Direction** submenu of **Structure** menu:



Document windows will be updated as shown below. Additional green line will appear between the rectangle of base object and the rectangle of recently created object. You may note that swells of object path now have changed 'more radial' behavior.



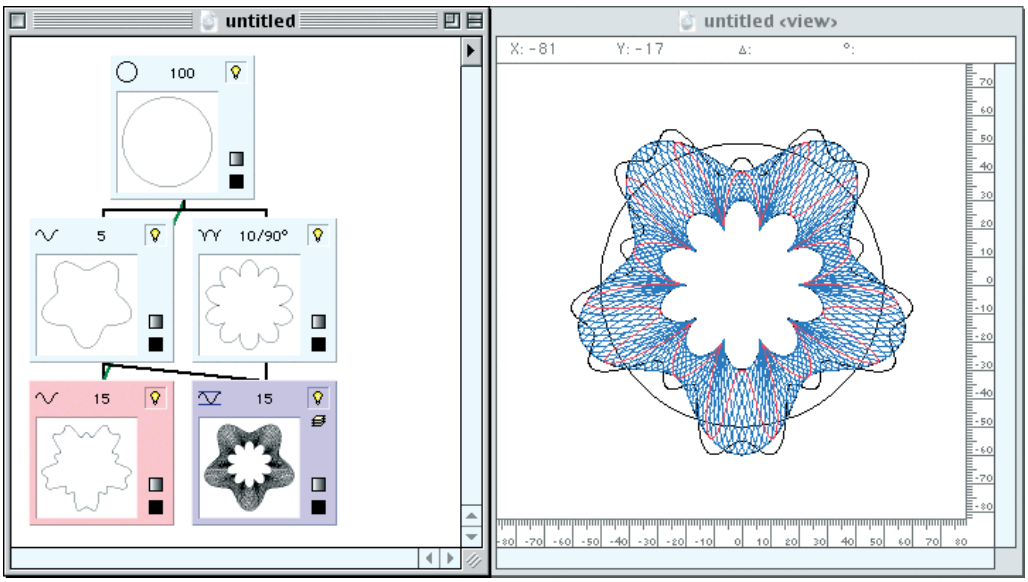
Summary: One *Excentro* object may have another object set to guide its **direction** and shape. To do so you should select the first object with mouse click, then the second object with **Shift**-click and choose **Structure->Direction->Set** command.

Comments: *Path of **direction** object controls rotation of element's movement (see next **Basic Conceptions** chapter for more details about movements and guilloche mechanics). By default the object moves along the path of its base (parent object) and rotates together with the tangent line to this path. You can modify this default behavior by setting another object as **direction** object, in this case the object still moves along the path of its base (parent object), but now it rotates together with the tangent line to the path of its newly specified **direction** object. Sometimes specifying direction object is a god idea when base path is not a smooth curve or has sharp corners (like **Rectangle** base object, for example). If you will set another object with a smooth path as **direction** object, you will be able to avoid unwanted sudden jumps and path breaks.*

*You can restore default behavior by choosing **Restore** command from **Direction** submenu of **Structure** menu.*

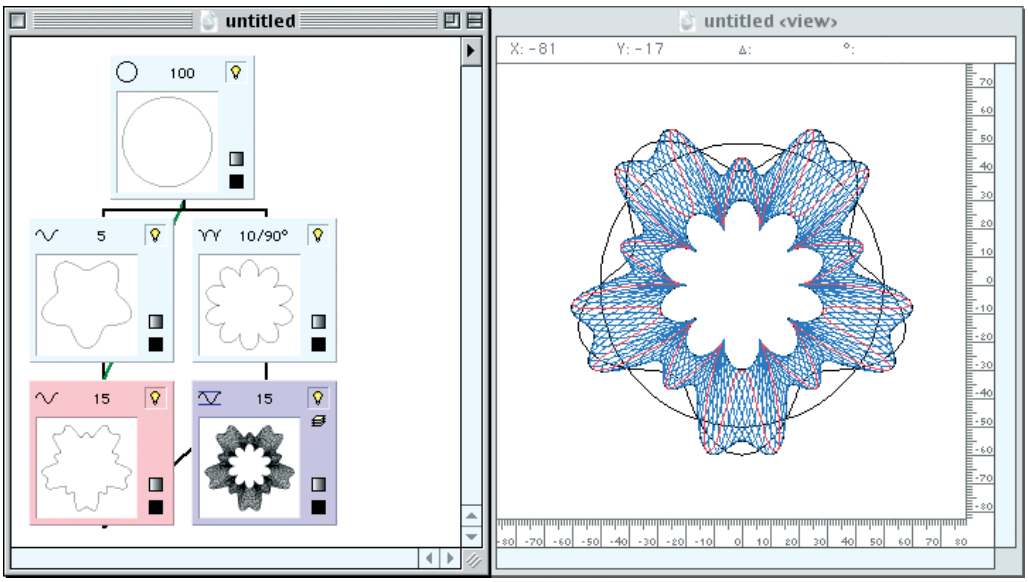
Direction object should not be dependent on the object it will be set to (i.e. it or its parents should not have connections to this object).

■ **Step 14.** Click the object we created in **Step 6** (right object in third row, the one with two parent objects and Step &Repeat Set) to select it. Hold down **Shift** key and click the object we created in **Step 9** above (left object in third row, the one with circle set as its direction guide). Its color will become reddish.



Choose **Change Second Base** command from **Structure** menu:

Document windows will be updated as shown below. Connection between the selected object and its second parent will be changed to the second selected object on the third row. Paths of the selected object and its Step & Repeat Set now will be located in between its original parent on the second row and its new parent on the third row:

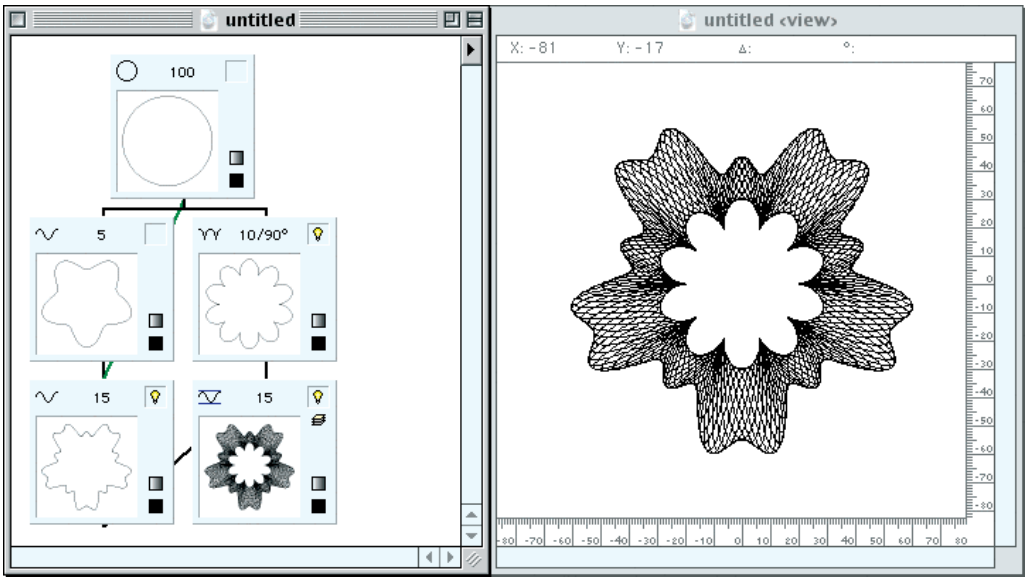


Summary: *Excentro* object may have its parents objects changed at any moment. To do so you should select the object with mouse click and the object you want to become its new parent with **Shift**-click and choose **Change Base** or **Change Second Base** commands from **Structure** menu.

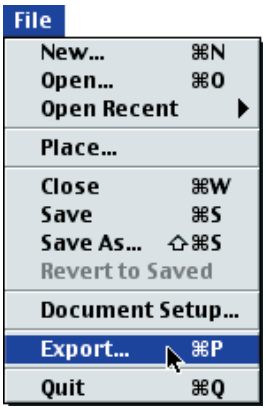
Comments: *Example above shows change of the second parent object for content elements but the same is true for the first parent object of content element or single parent object of regular (non-content) elements, just use* ***Change Base*** *command instead.*

New parent object should not be dependent on the object it will be set to (i.e. it or its parents should not have connections to this object)

■ **Step 15.** As the last finishing touches to our simple guilloche design in this introductory tutorial click 'light bulb' icons in top right corner of rectangles for top base object and the left object in the second row. 'Light bulb' will disappear and paths of these objects will become invisible. This invisible paths will not appear in exported document.



Now you can choose **Export** command from **File** menu to export document in *Adobe Illustrator* format. *Adobe Illustrator* application will be launched and window with this simple design will be opened automatically.



CHAPTER SUMMARY

In this chapter we tried to give you a brief illustration of what guilloche creation process in *Excentro* looks like. To sum it up: you create and arrange objects of guilloche design with **Structure** menu and change their attributes in **Excentro Control** inspector.

You were shown all basic *Excentro* tasks. You performed actions that:

- create objects of all classes: base objects, regular elements and content elements;
- duplicate existing objects;
- modify object attributes;
- add Step & Repeat Sets to objects;
- set object's direction;
- change object's parent objects;
- export finished design in *Adobe Illustrator* format;

Rest of **Using Excentro** guide elaborates on details of these actions and explains how to create guilloche designs of different types.

CHAPTER 2: BASIC CONCEPTIONS

In this chapter we describe mechanical model that lies in the heart of *Excentro* application and introduce few terms that will be used throughout this guide. If you have read previous **Introductory Tutorial** chapter you are already familiar with those terms (***base***, ***direction***, etc.), here we add some more details and explanations that will help you to understand guilloche design process in *Excentro* better.

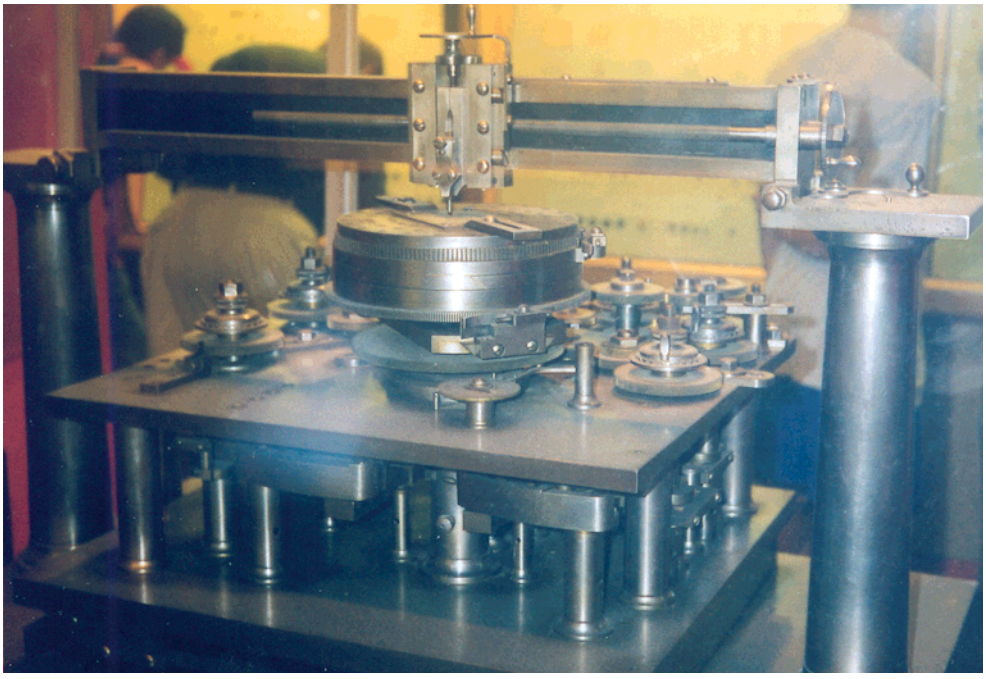
HISTORICAL BACKGROUND

Traditionally, to create guilloche designs you needed a special mechanical device called 'guilloche machine'. Or, rather, guilloche designs are called this way because they were created with help of guilloche machines. If you look into American Heritage Dictionary you will find that: Guilloche is: *"an ornamental border formed of two or more curved bands that interlace to repeat a circular design"* this word has French origin and also mean *"tool used in making the ornamentation"*. Webster Dictionary adds more details and says that the device was named after some French inventor named *Guillot* (but this name does not sound convincing and reminds more of a different kind of device).

Guilloches and guilloche machines were mostly used to decorate jewelry items until in early XIX century they were adopted to engrave plates for banknote printing. Some sources name Asa Spencer from Connecticut (USA) as the person who constructed and patented first machine that was used to engrave banknotes back in 1815.

Typical guilloche machine is a geometric lathe — an engine turning device that uses complex arrangement of cogs and wheels to create a composite circular movement of a plate. While plate moves a static point cuts in it an intricate path that will be filled with ink to produce complicated but regular pattern on paper at print time.

A picture below illustrates the idea: the guilloche machine exhibit from one of the public museums in Washington (USA):



EXCENTRO MODEL

The mechanical model used in *Excentro* differs from that of traditional guilloche machine: it is easier to understand and control, yet at the same time it lets you create complex designs, without learning about mechanical stuff like cams and gears.

You do not have to know anything about guilloche machines to use Excentro. In fact you can skip two following paragraphs and go directly to **Structure and Bases** section.

Well, in case you wonder:

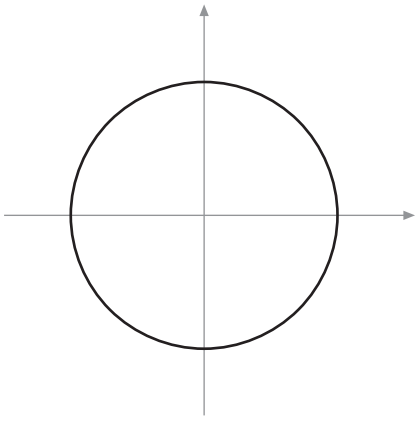
■ First difference of *Excentro* mechanics from traditional guilloche machine is an observer position. In traditional guilloche machine the plate is a moving part, the cutter point is stationary. *Excentro* model uses opposite point of view: the cutter moves upon the stationary plate. There is not much difference — resulting paths are the same, but the benefit is: it makes it easier to refer to the whole guilloche design. From observer's point of view plate never rotates, so its top is always upper part, bottom is always lower part. In this way *Excentro* model is more in resemblance to *spirograph* (a game popular back in 60s when 3D computer games were not the only idea of fun for children). Spirograph used two cogwheels: first cog had a hole through which pencil was inserted, this cogwheel rotated around second cogwheel and pencil left a complex circular pattern on a sheet of paper.

■ Second difference is terminology and the way paths are created. Traditional guilloche machine is operated through changing configuration of its mechanical parts: gears , eccentrics, cams and wheels. So, every single path is created as a combined movement of several parts of the machine. Operating machine like that requires a lot of experience and practice. Otherwise you will not be able to get predictable results. In *Excentro* complex paths are created incrementally, step by step, each step is a simple movement that adds more complicity to the path that was created at previous step. There is no limit to number of steps and movements you can combine this way. *Excentro* does not use classic guilloche terminology like 'wheels' because it would make things more difficult to grasp for most of computer users who never seen guilloche machine in their life.

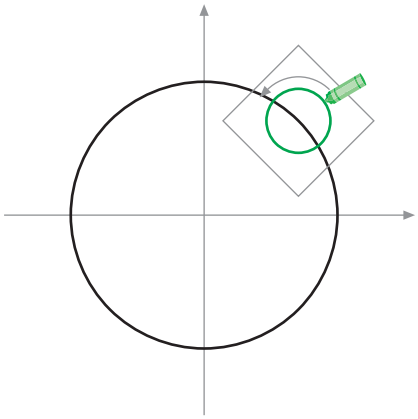
STRUCTURE AND BASES

So, let us depict *Excentro* mechanics:

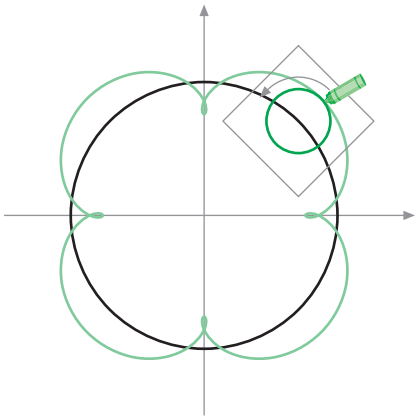
1. Imagine a flat surface, let us call it 'tabletop'. On this tabletop some basic geometric shape is drawn. It could be a circle, a square, a line.



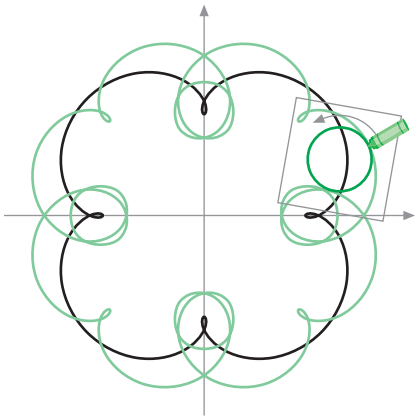
2. Imagine a flat object — 'sheet' that moves upon the tabletop along the path of basic shape. At the same time, second object — 'pencil' moves upon the sheet and draws on the sheet another simple geometric shape like circle.



3. Now imagine that the sheet is not a plain paper but in fact it is a copy paper, so the pencil leaves trail on the tabletop beneath the sheet too. This resulting path will be more complex than either of the simple shapes that were used to create it, it will be curly curve mathematicians call Epicycloid.



4. Now if we will use this newly created path as a base for another movement of the sheet with pencil, the second trail the pencil will leave on tabletop will be even more complex.



In *Excentro* every path (except for the first basic ones) is created as a result of a movement and could serve as a base for another movement and next new path. To create new path you need to choose existing path and define the way the pencil moves upon the sheet, while the sheet moves along this path.

Excentro documents use tree-like **structure** to represent the path construction. Each element of the structure is a movement of the sheet along the path represented by its parent element. Root element of the tree is a basic geometric shape on tabletop all subsequent movements are based on.

We will use term **base** to refer to both: first root element ('a base of structure') and parent element of some current element ('a base of current element').

Following picture shows *Excentro* document structure for paths created in numbered paragraphs 1-4 above.

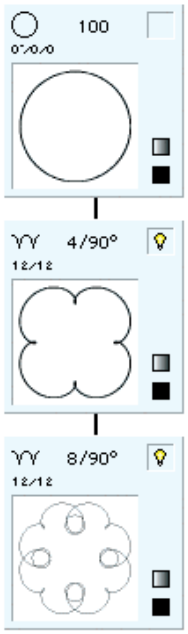
Circle.

The first basic geometric shape on tabletop. Root of elements tree structure; ***base*** *of document structure.*

Epicycloid.

Movement of sheet with pencil along the path of root-circle. Circle is a ***base*** *of this element.*

Movement of sheet with pencil along Epicycloid. Epicycloid is a ***base*** *of this element.*



Root element (the first basic geometric shape on tabletop) define type of all future path construction process and kind of guilloche design.

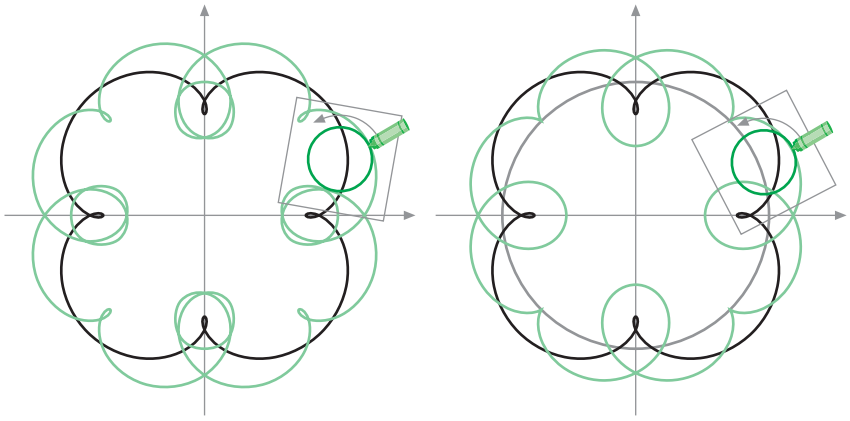
- Circle or ellipse could be used as bases for designs of circular type like rosettes.
- Line may serve as a base for linear designs like bands, borders or backgrounds.
- For frames you can use square or rectangle bases.
- Spiral bases could be used for something less traditional.

DIRECTION

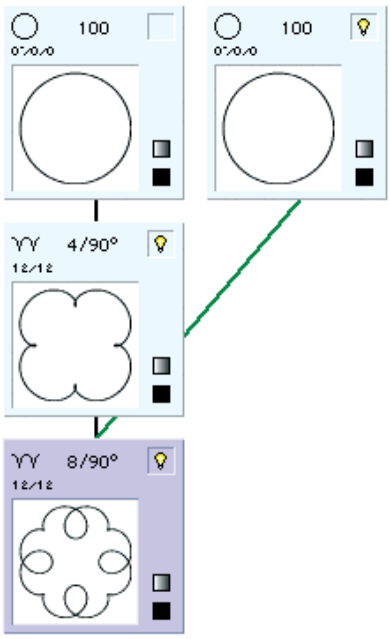
While the sheet with the pencil moves along its base path, it can also rotate around its center point. In usual case the direction of the sheet movement is always parallel to the direction of the base path (parallel to the tangent line of the base path, to be specific). Sometimes you may want to change this default behavior and appoint another path (different from the one that belongs to its base) to control the sheet rotation. As an illustration, compare two pictures:

left picture: direction of the sheet movement is controlled by its base path — Epicycloid; you may see that the pencil draws double coils because the sheet makes extra rotation around its center;

right picture: direction of the sheet movement is controlled by another path, in this case, a circle drawn on tabletop; the pencil draws single coils because the sheet no longer rotates around its center.



We will use term **direction** to refer to element of document structure, different from base element, that controls rotation of the sheet with pencil while it moves along the path of its base element.



Rotation of the sheet with pencil is controlled by second circle on tabletop.

*This element has circle as **direction** element.*

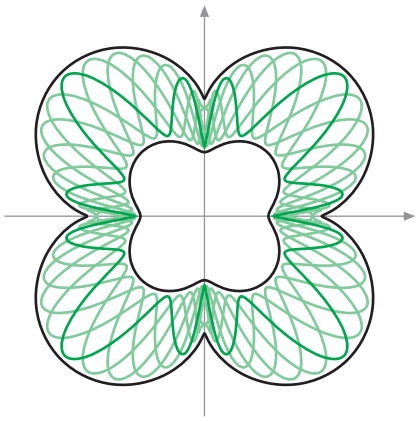
There are two common cases when setting up a direction element is a good idea:

- When base path has sudden twists and coils (like in case above) you can set up simpler path (usually the path that belongs to the base element of its base element or the root element of whole structure) to control the sheet rotation and avoid unwanted coils.

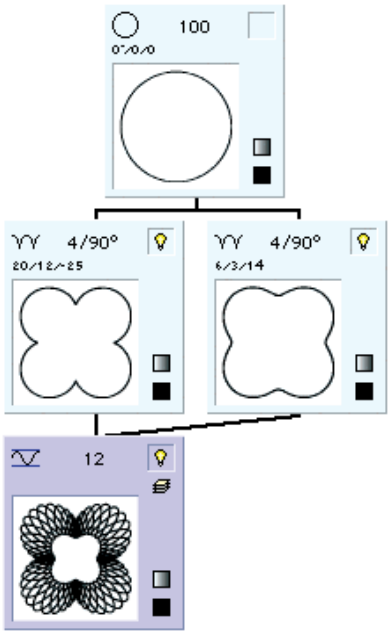
- When base path is not a smooth curve or has sharp corners (like basic shape of rectangle type) you can set up another smooth path to guide sheet direction and avoid sudden jumps and path breaks.

CONTENT ELEMENTS

If you will look at any finished guilloche design you will see that there is a whole class of paths that seems to fill space between two other paths.



Such elements in *Excentro* document structure are called **content elements**. Content elements have two parent elements. First parent element is referred to as a **base** of this content element, second parent is a **second base** of this content element. Paths of content elements are created by pencil movement between paths that belong to its two parent elements.



***Content element** fills space between two its bases.*

Content elements often have Step & Repeat Sets added two them. These sets allow to create additional paths by modifying one or more of element properties with increment values. Pictures above show content element with Step & Repeat Set.

CHAPTER SUMMARY

From this chapter you should get the basic idea that guilloche designs have mechanical origin and are created with special devices called guilloche machines. *Excentro* application is a virtual implementation of similar mechanical device.

Instead of wheels and gears *Excentro* uses tree-like **structure** to represent mechanical movement that creates guilloche path.

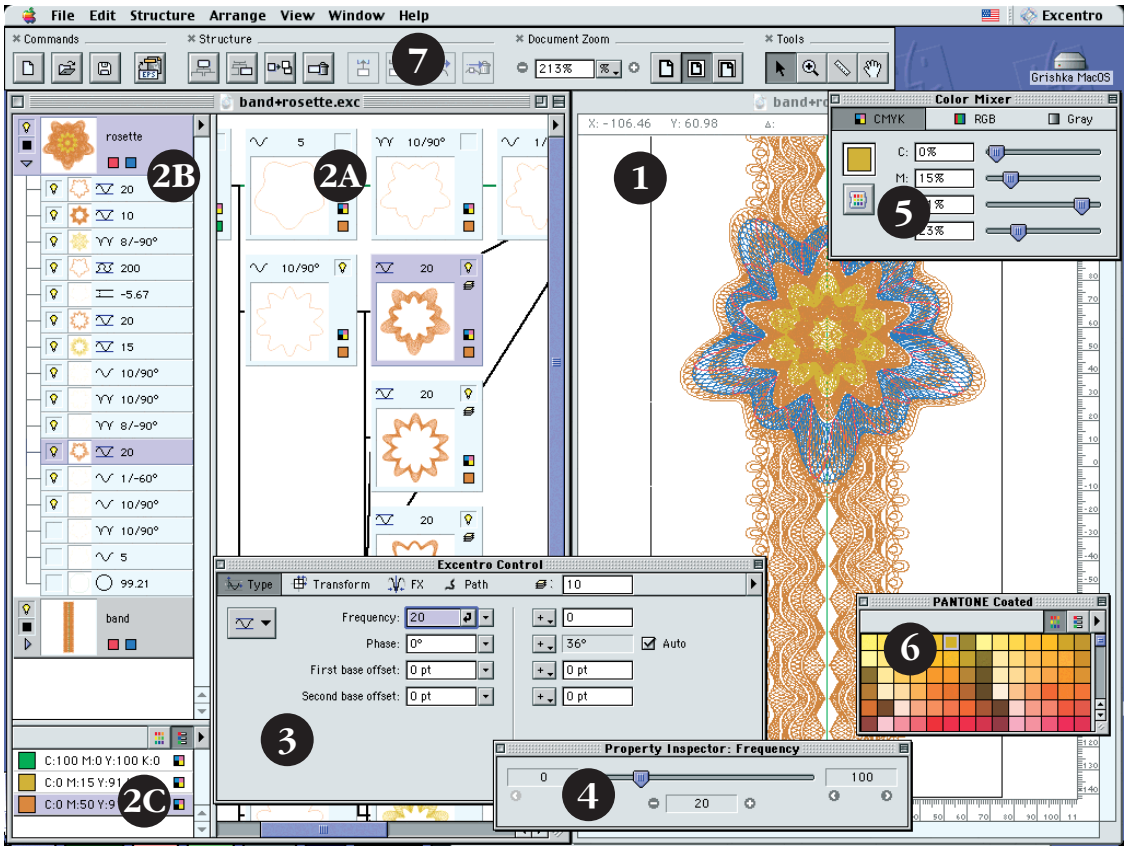
Main terms introduced in this chapter are:

- **base** — a root element of the structure: basic path that defines the type of guilloche design; or a parent element of current element: a path current element moves along.
- **direction** — an element that guides rotation of current element while it moves along the base path.
- **content element** — an element that has two parent elements; path of content element fills space between paths of its two bases

CHAPTER 3: USER INTERFACE TOUR

This chapter gives you quick overview of *Excentro* application user interface with short descriptions of windows and controls you may see on the screen during your work. Detailed description of every *Excentro* window and menu could be found reference books of *Excentro* manuals set: **Excentro Windows Reference** and **Excentro Commands Reference**.

General view of *Excentro* work area is shown on picture below.



Depending on the task you are working on some windows might be closed to save screen space and reduce clutter. For example, while you are working on basic guilloche geometry you can close or hide windows and panes that show color information and objects in layers list. The picture above does not show recommended arrangement of windows you should follow — just some typical view of *Excentro* work area.

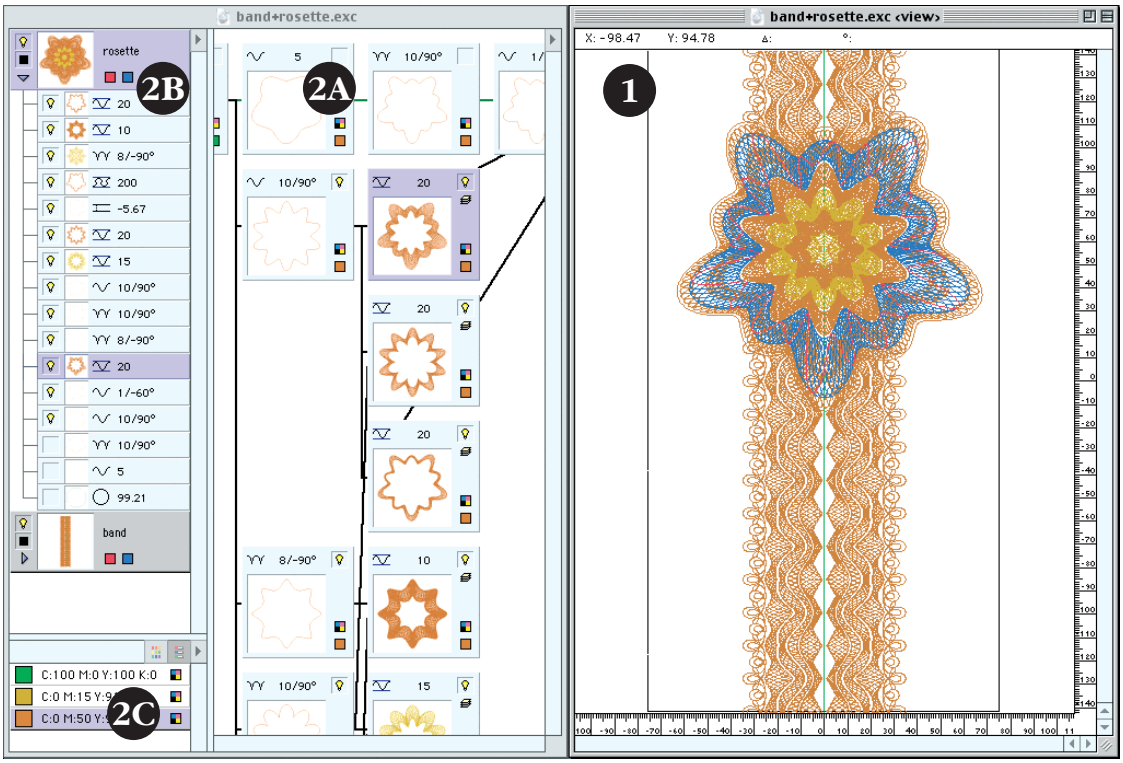
DOCUMENT WINDOWS

Unlike documents of other applications *Excentro* document has two windows associated with it. Both windows (numbered as **1** and **2**; window **2** consists of three panes **2A**, **2B**, **2C)** show the same document content in two different ways.

Window **1** is called **document preview window**. It has **<view>** suffix after document name in its title bar and is located in the right part of the screen. This window is used to

show document content preview as graphics. Actions you can perform with this window are limited to scrolling, zooming and objects selection. Because precision is the most important issue for guilloche design *Excentro* does not provide means to edit graphics with mouse movement of spline control points, like general purpose vector drawing applications do.

You can change display mode of **document preview window** with commands in **View** menu. You can change zoom magnification with **View** menu or **Document Zoom** section of **Toolbar**. You can perform different actions in **document preview window** with one of four tools from **Tools** section of **Toolbar**: **Selection Tool**, **Zoom Tool**, **Measure Tool** or **Hand Tool**.



Second document window **2** is called **main document window**. It shows document content in internal to *Excentro* way as a structure of interconnected elements (pane **2A**). This window also contains additional panes **2B** and **2C** that show the list of document layers with objects they contain and the list of colors used to colorize paths of objects in this document.

Pane **2A** shows tree-like structure that represents guilloche paths construction process mentioned in previous chapter. You will use this pane to create and change guilloche geometry: make new guilloche objects, change their parent objects, set direction objects, etc. Commands for these operations are located in **Structure** menu or **Structure** section of **Toolbar**. Elements could also be rearranged or copied with simple drag and drop actions.

Another use for drag and drop in this pane is setting up paths stroke color by dropping color patch from **Color Mixer** or **Swatch Palettes** on rectangle that represent target element.

Panes **2B** and **2C** are located on resizeable pane in the left part of the window. This resizeable pane could be hidden completely with commands from document window pop-up menu (button with triangle in top right corner of the window).

Other graphics applications use special floating windows to show lists of layers and colors for current document. Since *Excentro* uses more than one window to display single document content we decided to avoid additional confusion and put lists of layers and swatches into the main window of each document. This also simplifies copying of layers and swatches between documents with drag and drop.

Pane **2B** is **layers list**. It shows and could be used to change document layers arrangement and visibility. Layers operations: creation, deletion, merging, etc. are performed with layers list pop-up menu in right top corner of this pane.

Another purpose of **layers list** is to display structure elements in front to back drawing order. You can change this order by simple dragging of elements representations in the list or with commands from **Arrange** menu.

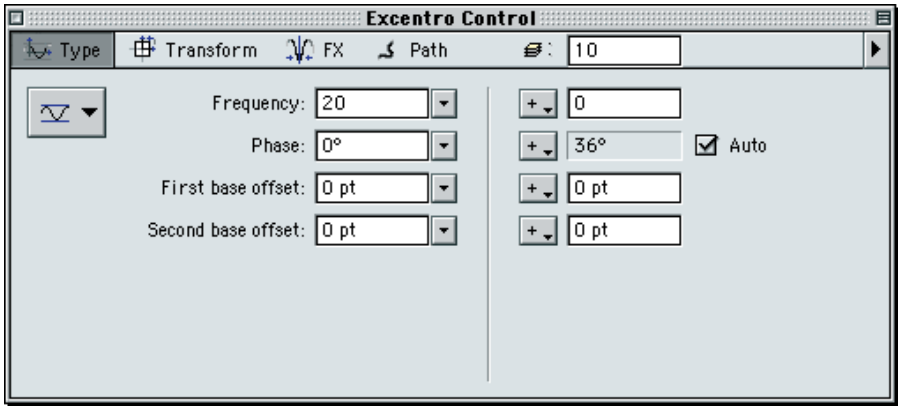
Pane **2C** is the document's **colors list**. Like in other graphics application you can keep in this list set of frequently used colors for this document. Because guilloche graphics are often printed with fixed number of spot colors, this list allows you to simplify color selection operations. To add and delete swatches in the list you can use pop-up menu in right top corner of this pane.

INSPECTORS

Besides document windows, *Excentro* has a set of special windows that float above the document windows. These windows are used to display and control different properties and attributes of objects in the document windows. They are called **Inspectors** or **Inspector windows** and could be summoned with commands from **Inspectors** submenu of **Window** menu.

At present there are three inspectors: **Excentro Control**, **Property Inspector**, and **Color Mixer**.

Excentro Control (window number **3** on the picture on the first page of this chapter) is the most important inspector window. It shows and controls <u>all</u> properties of document structure objects. You should use this window to change everything from type of guilloche design and its geometric sizes to color, cap, join and overprint attributes of their paths.



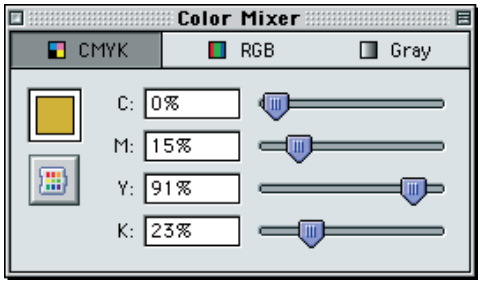
Excentro Control window may have three different sizes that depend on number of Step & Repeat Sets the selected element has. Additional Step & Repeat Sets could be created with pop-up menu in top right corner of this window.

Four panels: **Type**, **Transform**, **FX** and **Path** contain fields with different object's properties:

- **Type** panel groups together attributes that are specific to the type of the selected object. Number of fields, their names and positions may change as you select objects of different types in the document windows or change type of selected object with **Type** pop-up menu.
- **Transform** panel contain fields that specify geometric transformation of object's path. You can set individual scale, skew, rotation and offset values for every object.
- **FX** panel lets you add special effects like frequency modulation and symmetry to objects of certain types.
- **Path** panel sets attributes of object's path like: cap, join, stroke color, overprint. It also lets you specify if path is closed or not and see number of nodes (or spline segments) the path consists of.

Property Inspector (window number **4**) is inspector window that allows you closer manipulation with the value of the selected attribute in **Excentro Control** inspector. This window has a slider control to change attribute value in real time mode by dragging slider indicator and **+**/**–** buttons to modify attribute by small increment/decrement values at time. Title of **Property Inspector** window changes to reflect the name of the selected attribute in **Excentro Control** inspector.

Color Mixer (window number **5**) is not much different from the inspector window of same name of *Macromedia FreeHand* application. It allows you to manipulate current color attribute values with numeric fields or slider controls and convert colors between different color spaces.

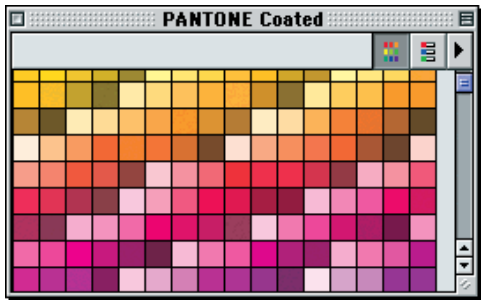


Unlike **Color** palette of *Adobe Illustrator* **Color Mixer** is not directly connected with the selected object in the document windows. This way you do not have to deselect current element just to experiment with color sliders. To set path stroke color of the object in *Excentro* document to that of the current **Color Mixer** color you should either drag color patch from color well of **Color Mixer** to color well of **Path** panel of **Excentro Control** inspector or drag this color patch directly to this object's rectangle representation in structure pane of main document window.

SWATCH PALETTES

Swatch Palettes (window number **6**) are another kind of special floating windows used in *Excentro*. They are managed with **Swatch Palettes** submenu of **Window** menu.

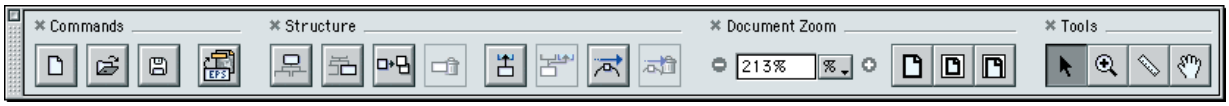
These windows could contain lists of colors for industry standard color systems like PANTONE® saved in EPS or *Adobe Illustrator* palette format or just any list of swatches you want to use saved in native *Excentro* document format. Files shown in **Swatch Palettes** submenu are located in folder '***Swatch Palettes f***' in the same folder as *Excentro* application. To add your own swatch palettes — just place more files into this folder and restart the application.



Just like with color of **Color Mixer**, you should use drag and drop actions to set one of **Swatch Palette** colors as path stroke color of document objects.

TOOLBAR

Excentro **Toolbar** (window number **7**) is not different from that of other *MacOS* applications. **Toolbar** is a special floating window that contains shortcut buttons to most frequently used commands in application menus, displays zoom magnification and lets you select current tool for manipulation in document preview window. **Toolbar** could be either anchored to top left corner of the screen or float around just like other floating windows. To change **Toolbar** options you may use **Toolbar** submenu of **Window** menu.



Excentro **Toolbar** has 4 main sections:

- **Commands** section contains shortcuts to commands from **File** menu like **New**, **Open**, **Save,** etc.
- **Structure** section contains shortcuts to commands in **Structure** menu you will use most often while working on guilloche geometry.
- **Document Zoom** section contains shortcuts to zoom commands from **View** menu. It also shows and lets you edit current magnification value of document view window by typing in the numeric field.
- **Tools** section of **Toolbar** lets you select current tool for operations in document preview window.

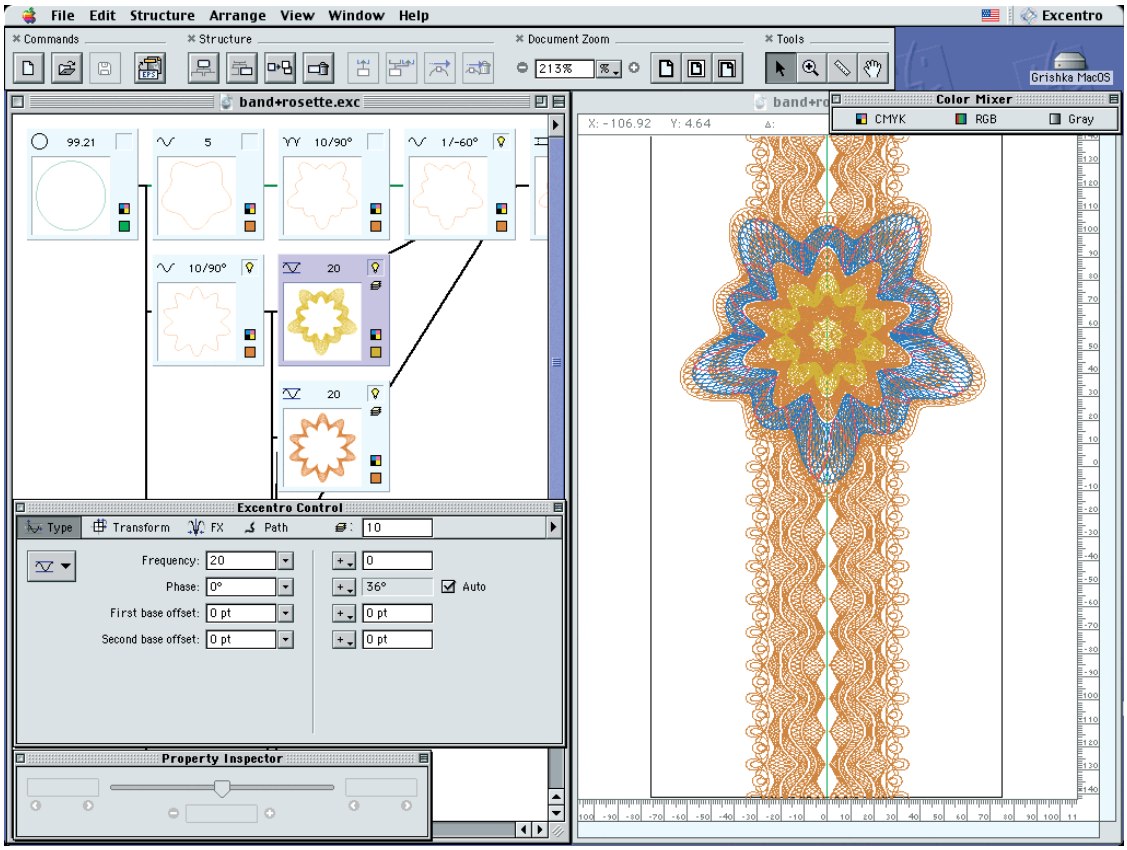
While running under *MacOS 9* and earlier you may see additional section of **Toolbar** window — **Memory Status** that shows amount of free memory left to application.

USAGE TIPS

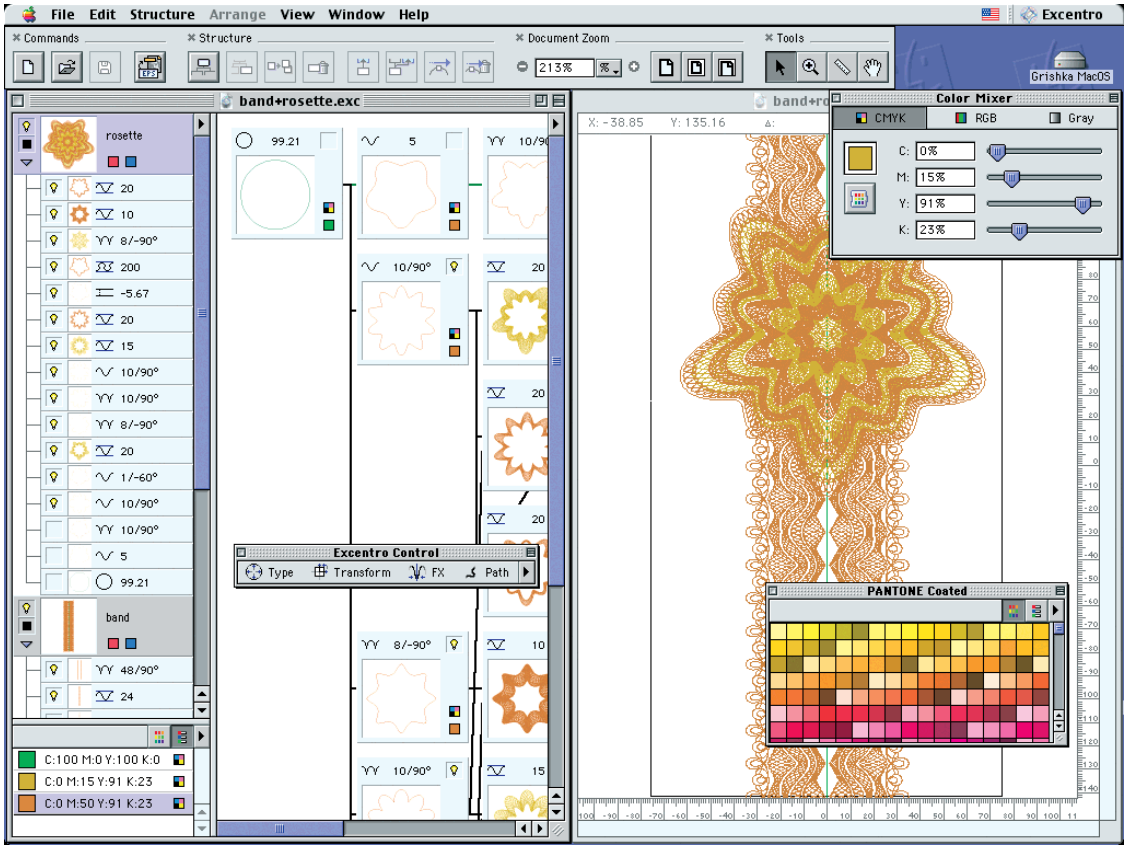
As mentioned above while you work on different tasks you may want to close windows and panes you do not need at the moment. Fortunately *Excentro* **Inspectors** and **Swatch Palettes** allow you to collapse them to minimize screen usage without closing windows. This is especially helpful under *MacOS X* operating system version that does not have built-in 'window shade' feature.

To collapse windows **Excentro Control** inspector, or **Color Mixer** inspector or **Swatch Palette** you should just click again the title of the selected panel. The window will shrink to panel title names and icons level and will hide panel controls. To expand these windows again click the title name of the panel you would like to see.

While you are working on basic guilloche geometry your screen may look like shown below: resizeable pane of main document window with layers list and colors list — hidden, swatch palettes windows — closed, **Color Mixer** window— collapsed.

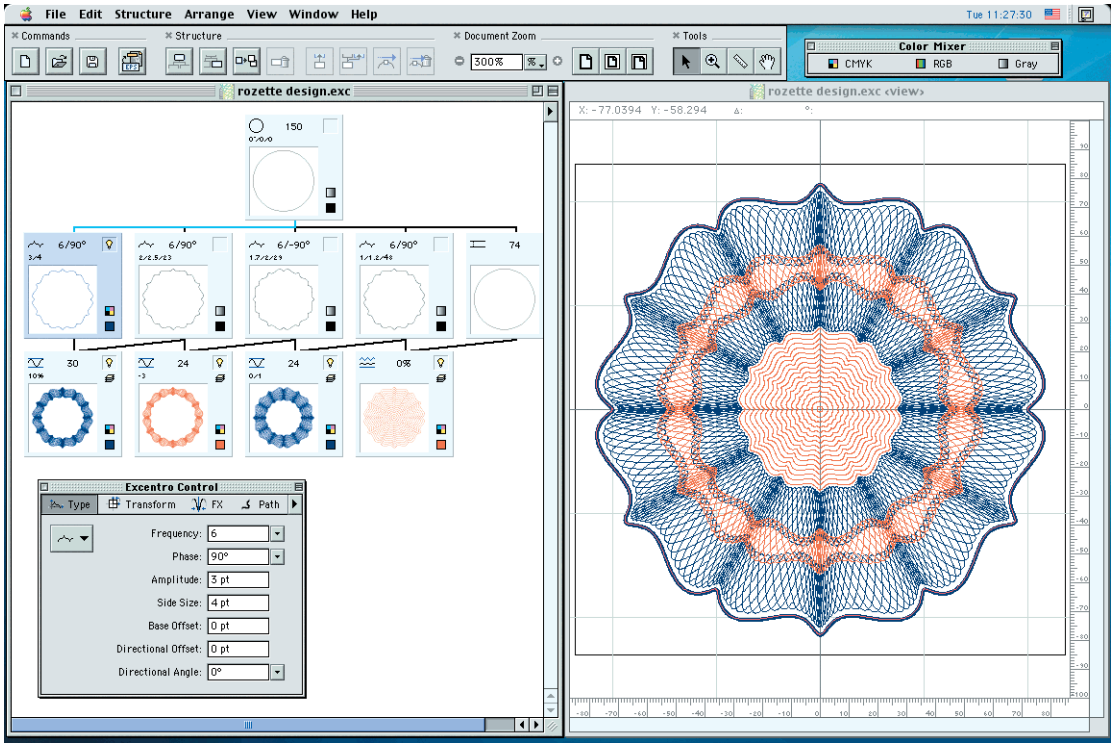


On the other hand, when guilloche geometry is created and all is left to do to finish the design is to assign stroke colors to visible paths and adjust back to front drawing order of layers and objects they contain, you may want to close **Property Inspector**, collapse window of **Excentro Control** inspector, call up needed swatch palettes and show layers list and swatches list of the main document window (see illustration on the following page):


File Edit Structure Arrange View Window Help
Excentro
Commands
Structure
Document Zoom
213%
Tools
Grishka MacOS
band+rosette.exc
rosette
band
Excentro Control
Type
Transform
FX
Path
Color Mixer
CMYK
RGB
Gray
C: 0%
M: 15%
Y: 91%
K: 23%
PANTONE Coated
X: -38.85
Y: 135.16

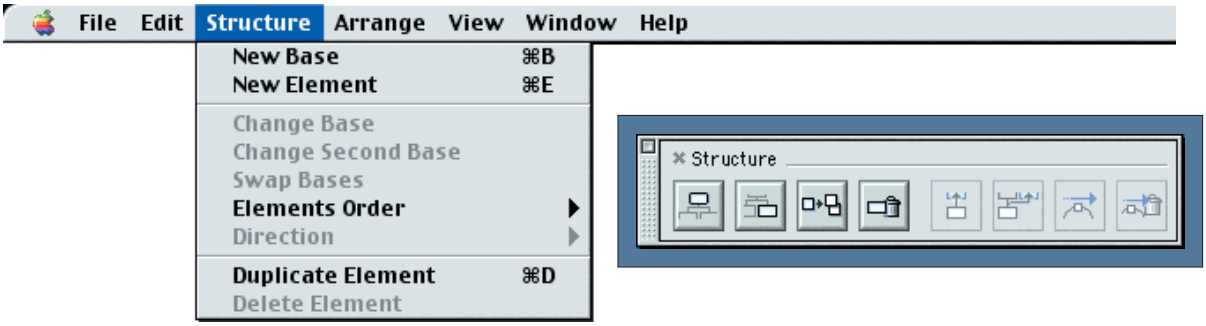
CHAPTER 4: STRUCTURE OF GUILLOCHE DESIGN

Excentro application employs two windows at once to display contents of its document:



The window located on the right is called **document preview window**. It shows document's content as graphics (similar to that of vector graphics tools like *Adobe Illustrator* or *Macromedia Freehand*), you can use this window to check shapes of guilloche paths at various magnification values or to select paths and elements they belong to with mouse clicks. The actual creation work happens in the window located on the left called **main document window**. This window shows the document's content as a tree-like structure of interconnected elements. The process of guilloche design creation in *Excentro* application constitutes the construction of this tree-like structure and the manipulation of the elements it consists of.

To create and rearrange elements of this tree-like structure you can use commands from **Structure** menu and their shortcut buttons in **Structure** section of **Toolbar**. To change attributes of individual elements of this structure, you can use fields and panels of **Excentro Control** inspector.

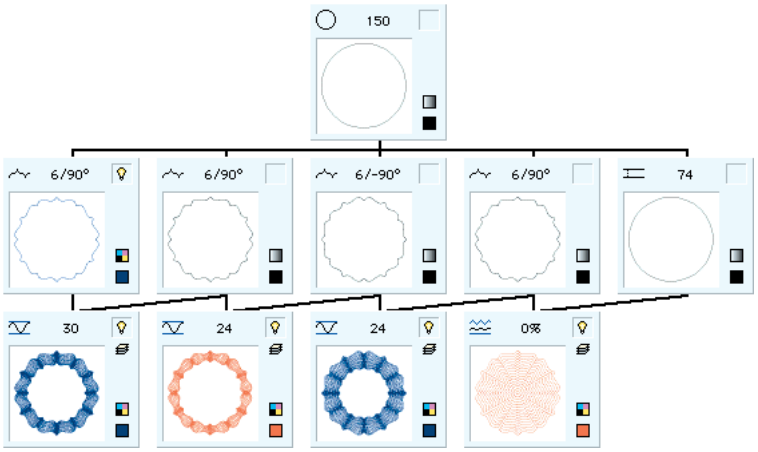


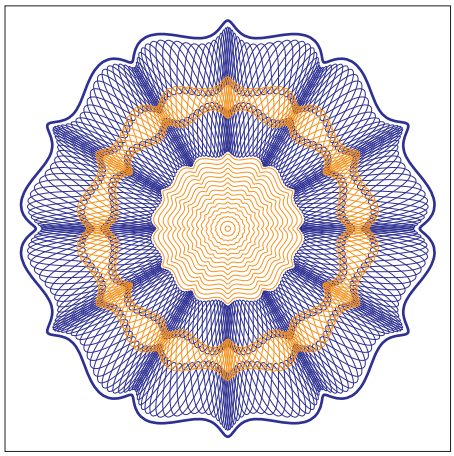
This chapter explains basics of the tree-like structure creation, so, this is probably the most important chapter of this book. For better understanding we suggest you to read **Chapter 2: Basic Conceptions** first, though it is not absolutely necessary.

ANATOMY OF GUILLOCHE DESIGN

Let us show the structure of a guilloche design and role of different elements it consists of using the most typical examples.

■ **Rosette.** The rosette is a circular design that usually consists of several concentric intersecting bands. The structure of a simple rosette is shown on the following picture:

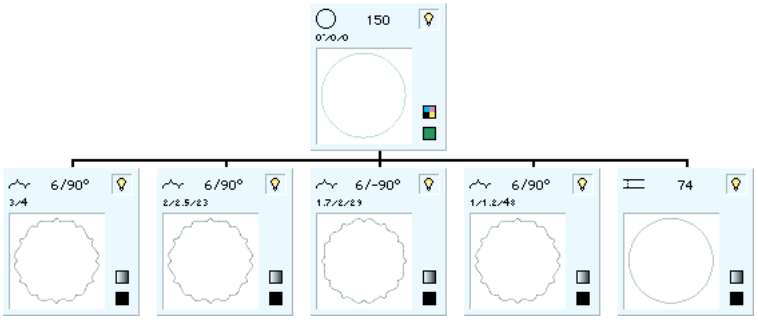


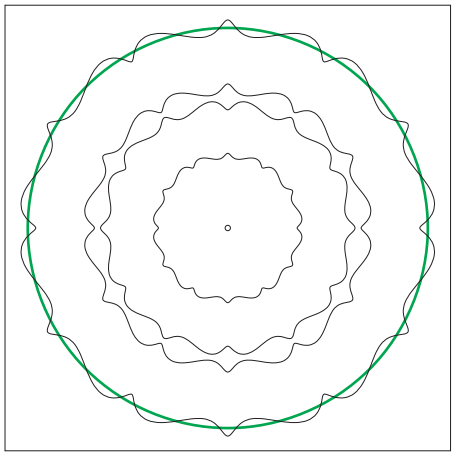


As you can see there are three kinds of elements in this tree-like structure:

◆ **1: Base Object.** The top element of the tree is a root object of the structure. All other elements are growing from this one. In terms of guilloche mechanics introduced in **Basic Conceptions** chapter this element is called **base** or **base object** and it represents the basic geometric path on 'tabletop' that other elements follow along. In simple rosette case the path of base object is a circle or an ellipse.

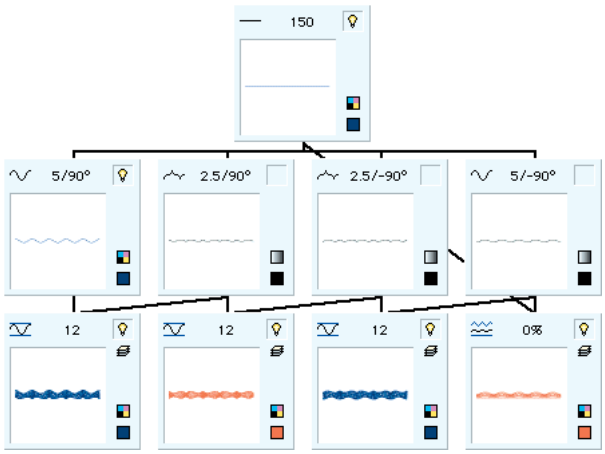
◆ **2: Regular Elements.** The elements on the second row of the tree structure represent modifications of the base path created with 'tabletop-sheet-pencil' mechanical model. These elements have single black connection line to their parent element. They serve as 'skeleton bones' of the design and control shapes of the internal and external areas of the rosette. The following pictures show only the base object and regular elements of our simple rosette design (the path of the base object is shown with green color).

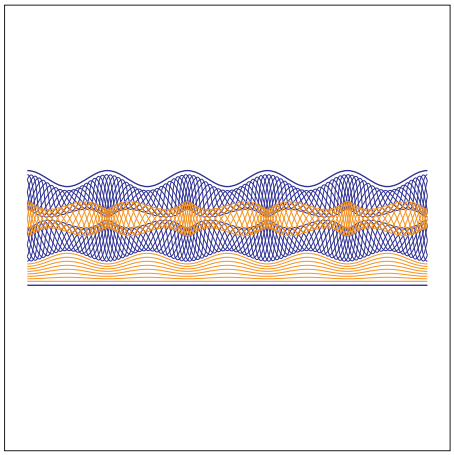




◆ **3: Content Elements.** The elements on the third row of the structure are **content elements**. They have two parent elements and are connected to them with two black connection lines. Paths of the content elements fill space between the paths of their parent elements with uniform vector texture. These elements could be regarded as a 'flesh' that covers the 'skeleton bones' and thus complete the rosette design.

■ **Border.** The structure of simple border design is similar to that of the rosette with the sole exception that it is not circular but flat or linear:

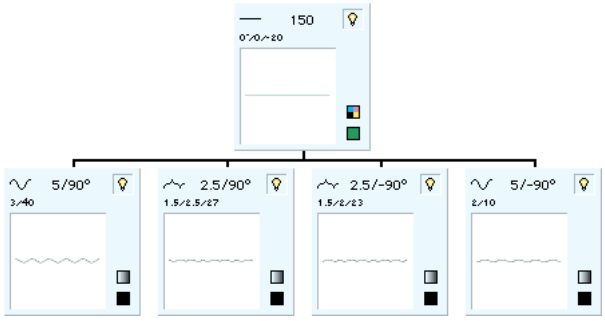


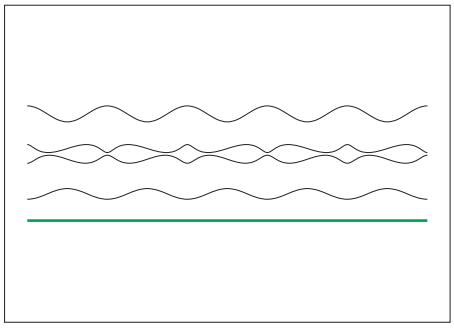


There are same three kinds of elements in this tree-like structure:

◆ **1: Base Object.** In case of a border the path of the root base object is a line.

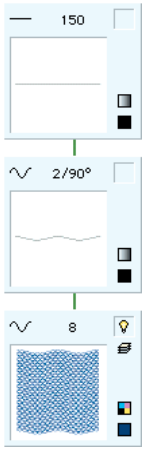
◆ **2: Regular Elements.** The 'skeleton' of the border is also formed by the regular elements on the second row. The paths of these elements control shapes of top and bottom background parts. They are shown on the next pictures (the base object is shown with green color).

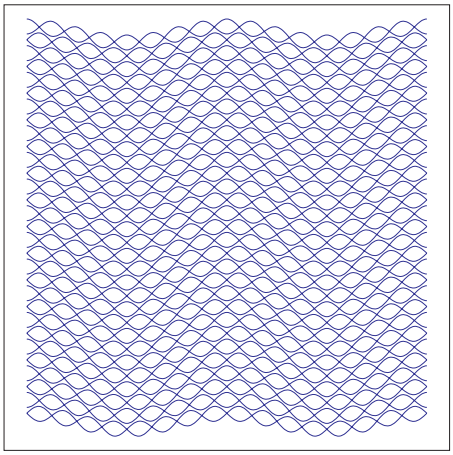




◆ **3: Content Elements.** Just like with the rosette, the content elements on the third row of the structure form vector 'flesh' of the border design.

■ **Background.** Typical linear backgrounds have much simpler structure comparing to that of rosettes or borders:

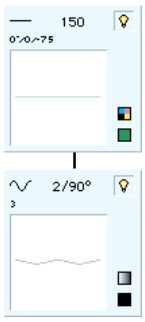


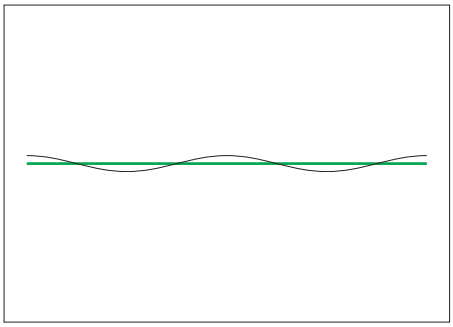


There are only two kinds of elements that participate in this structure tree:

◆ **1: Base Object.** The basic path on 'tabletop' that belongs to the root object of the structure is linear in the background case.

◆ **2: Regular Elements.** The regular element on the second row of the tree produce simple wave path shown on the following picture:





Next regular element on the third row makes this waves more complicated. Its paths are multiplied using Step & Repeat Set feature of *Excentro* application to cover the desired background area.

As was shown in the examples above there are only three types of elements that are used to create the structure tree of guilloche designs:

◆ **bases** or **base objects** that serve as roots of the structure and define the type of the guilloche design (circular rosette, linear border or background, etc.);

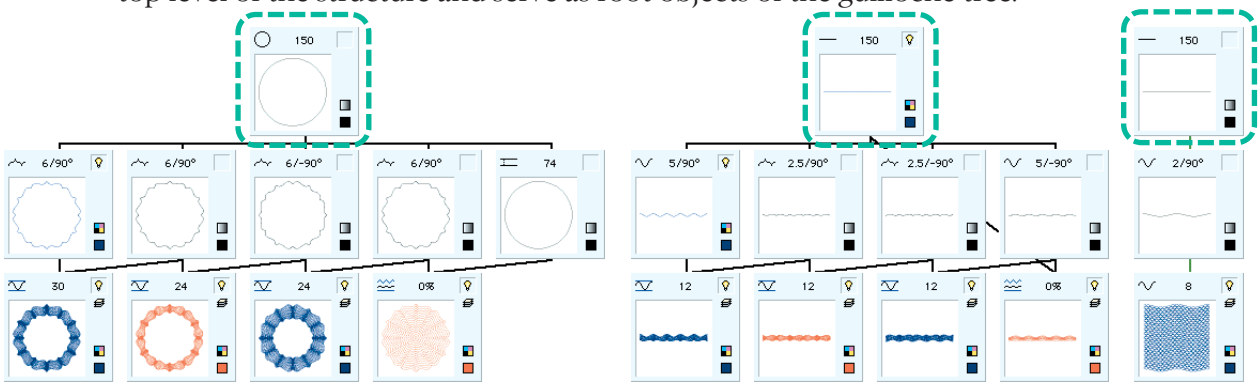
◆ **regular elements** that modify paths of base objects or other elements and create 'skeleton bones' of the design;

◆ **content elements** that add 'flesh' between skeleton bones and form vector texture of the guilloche.

Next three sections of this chapter discuss elements of these three different types in more details.

BASES

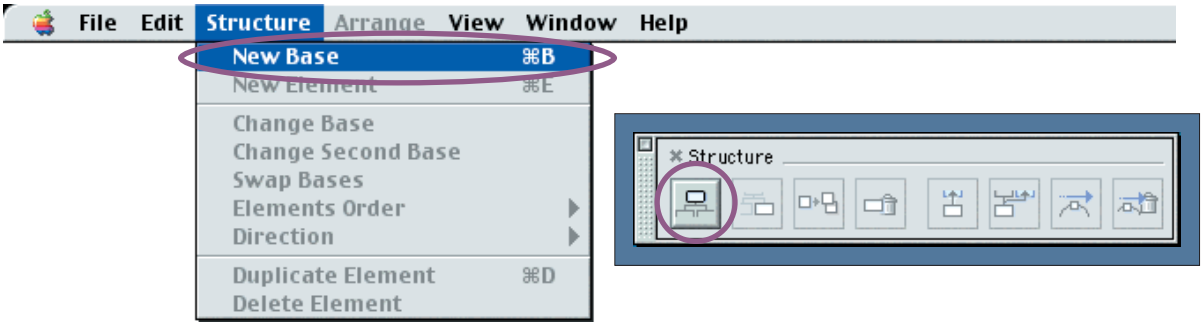
Bases or base objects are the first elements of every guilloche design. They are located at top level of the structure and serve as root objects of the guilloche tree:



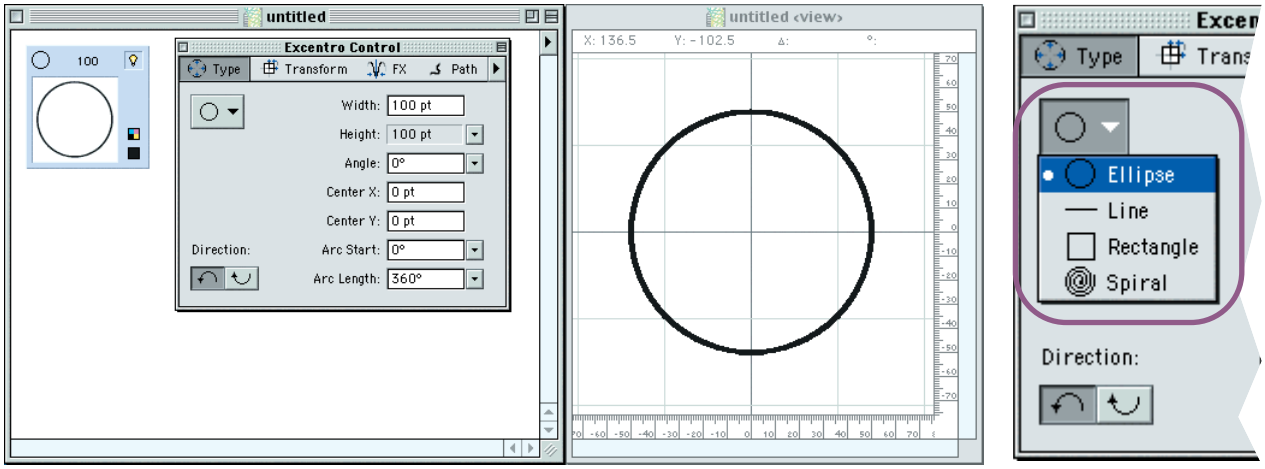
The path of the base object represents the first basic geometric shape drawn directly on 'tabletop'. All subsequent elements follow this path according to 'tabletop-sheet-pencil' mechanical model. Due to this reason the shape of base path defines the type of guilloche design: it should be circular for rosette designs and linear for borders and backgrounds.

■ **Creating Bases.** When you start with creation of new guilloche design, you should decide what type of design this will be (rosette, border or background) and create the base object with appropriate path shape and size.

To create new base object you can use **New Base (Cmd–B)** command from **Structure** menu or its shortcut button from **Toolbar**. This command is the only one enabled in **Structure** menu if you are creating guilloche design in a new blank document.

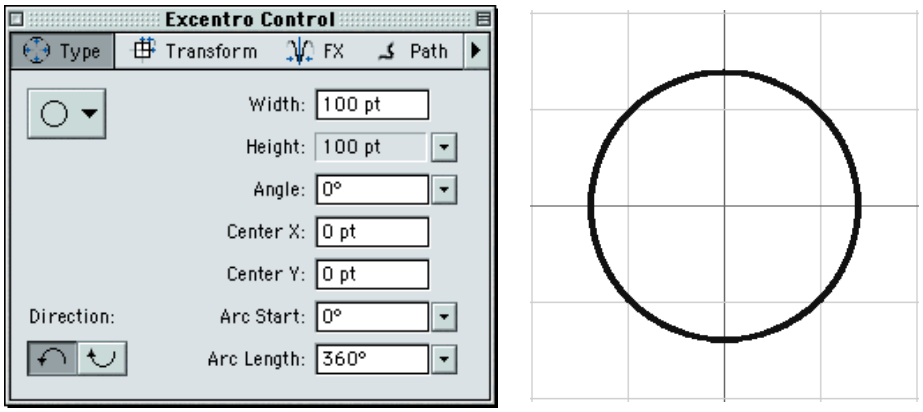


Default shape of the path for a new base object is a circle 100 points across. You can change it using **Type** pop-up menu and attribute fields from **Type** panel of **Excentro Control** inspector.

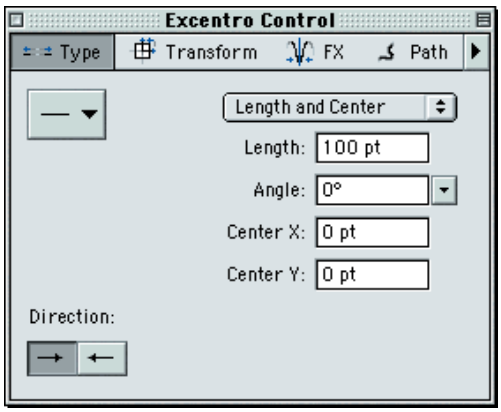


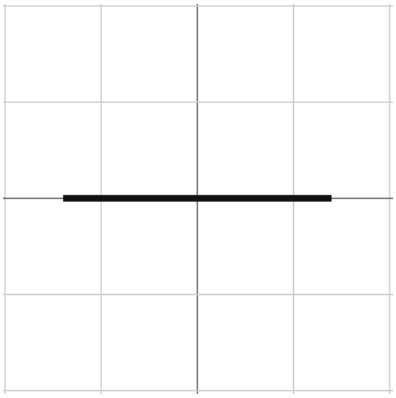
■ **Types of Bases.** Two most frequently used types of base objects are **Ellipse** and **Line**:

◆ The base objects of **Ellipse** type have circular or elliptic shapes. They are used mostly for rosette guilloche designs. **Width** and **Height** attributes define the size of **Ellipse** path. **Center X** and **Center Y** attributes define position of path's center on 'tabletop' of document preview window:



◆ The base objects of **Line** type have linear paths. They could be used for border or background designs. **Length** attribute define the length of **Line** path. There are several ways to define line position on 'tabletop' either with **Center** point attributes, or with **Start** point or **End** point attributes:

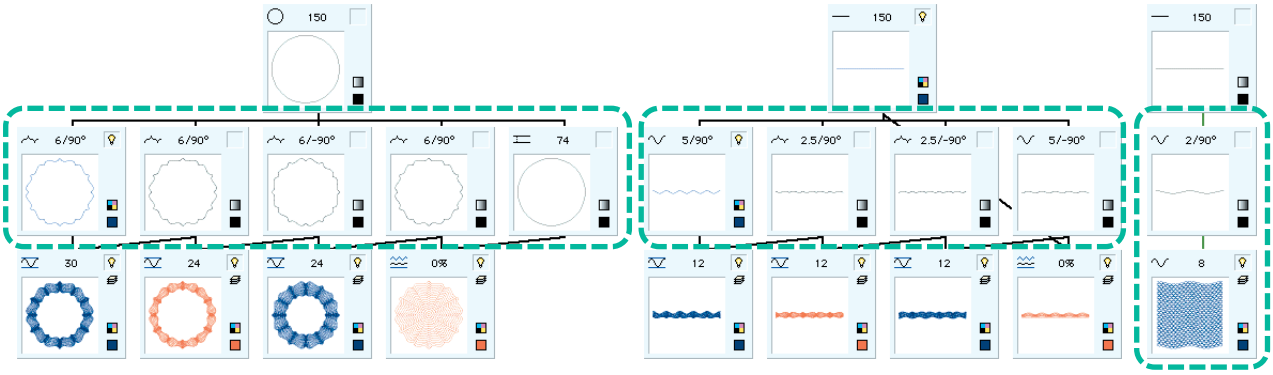




Detailed illustrated description of all base objects types and their attributes could be found in **Excentro Objects Reference** book. For this chapter's purpose we just mention again that creation of guilloche designs starts with creation of the base object (with **New Base** command), choosing its path type and setting its size and position.

REGULAR ELEMENTS

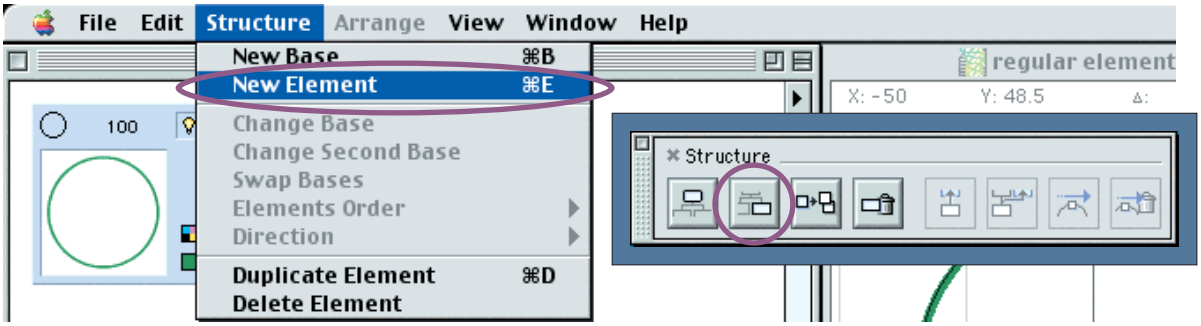
When the base object for new guilloche design is created, you should make modified versions of its path by adding regular elements to this object. Regular elements are located on the second and deeper levels of the design structure and have single black connection line to their parent objects on previous levels of the tree.



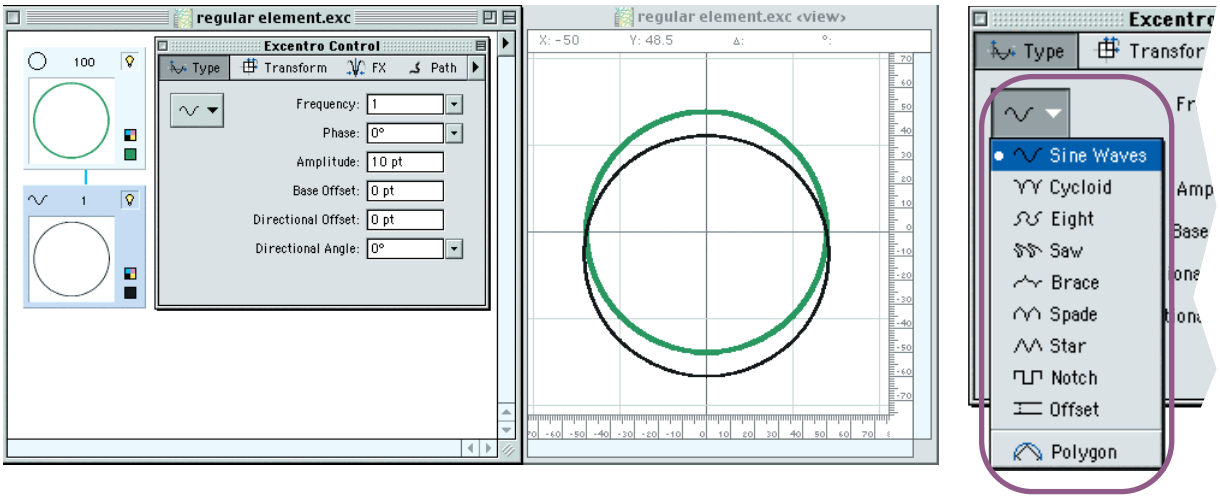
The path of the regular element represent modification of its parent object's path according to 'tabletop-sheet-pencil' mechanical model. Objects of any type (base objects, other regular elements and content elements) can serve as a parent objects for new regular elements. The path of this parent objects on 'tabletop' is traced by imaginary 'sheet' with 'pencil' that draws some simple shape on this 'sheet' at the same time. As a combination of these two movements we get complex 'wavy' or 'curly' modification of the parent object's path on 'tabletop'. There are several types of regular elements with each type defining its own specific shape that 'pencil' draws on 'sheet' while 'sheet' moves on 'tabletop'.

Together with the base object, regular elements form 'skeleton' of the guilloche graphics that control shapes and sizes of internal or external areas of whole design.

■ **Creating Regular Elements.** To create new regular element you should select existing element of tree structure with mouse click and use **New Element (Cmd–E)** command from **Structure** menu or its shortcut button from **Toolbar**. The selected element will become a parent object of new regular element in the tree with black connection line between them.

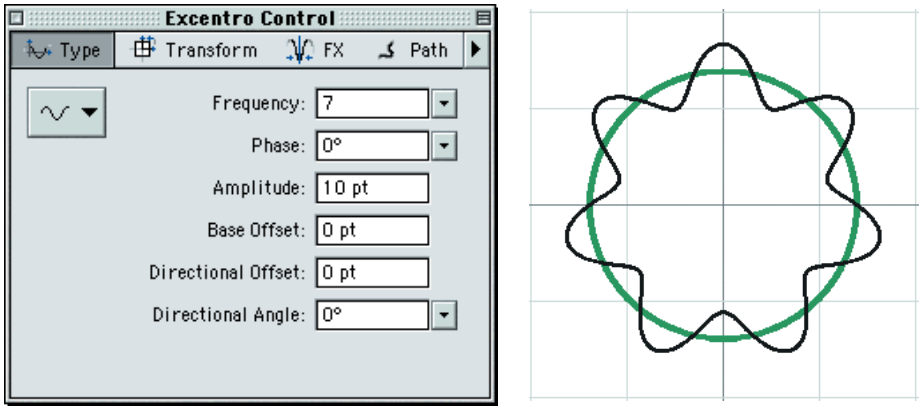


Default shape of the path for a new regular element is a 10 points high wave with single swell (**Frequency** = *'1'*). You can change it using **Type** pop-up menu and attribute fields from **Type** panel of **Excentro Control** inspector.

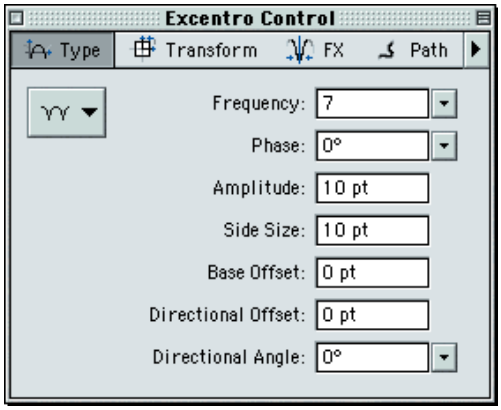


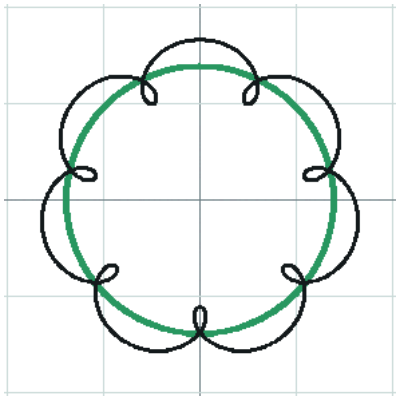
■ **Types of Regular Elements.** Two most frequently used types of regular elements are **Sine Wave** and **Cycloid**:

◆ The regular elements of **Sine Wave** type have wavy shapes with number of swells controlled by **Frequency** attribute. Starting position of the swells is set by **Phase** attribute value. Height of the waves is defined by **Amplitude** attribute. **Base Offset** attribute defines the distance from the middle of waves to the path of parent object.



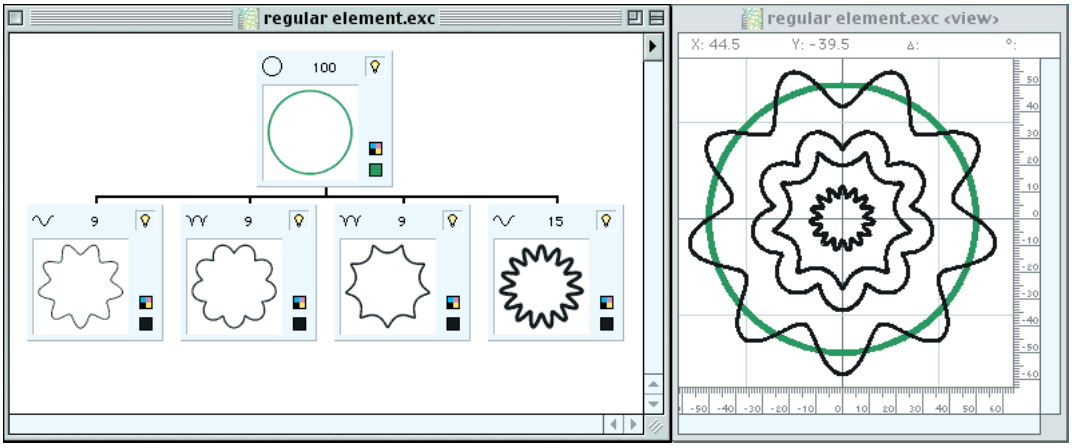
◆ The regular elements of **Cycloid** type have one additional attribute comparing to the elements of **Sine Wave** type — **Side Size**. This attribute defines width of cycloid coils. When the value of **Side Size** is relatively small, no coils will appear. When this attribute is set to '*0*' (zero), the path of **Cycloid** will be identical to that of **Sine Wave** with similar attributes.





As with the base objects, you can find the detailed illustrated description of all regular elements types and their attributes in **Excentro Objects Reference** book. In this chapter we just mention again that to create new regular elements you should select any other existing element in the tree structure and choose **New Element** command. After that you should modify attributes of new element and create other regular elements until desired geometry of guilloche 'skeleton' is reached.

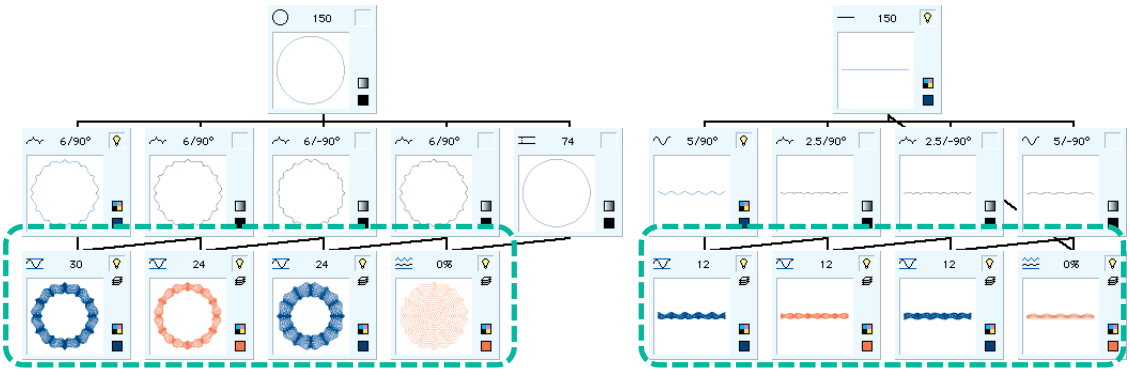
The following picture shows example of another simple rosette 'skeleton' formed by four regular elements.



CONTENT ELEMENTS

If you have the tree structure of a guilloche design with at least two elements you can create the third element whose path lies between the paths of these two existing elements. The class of elements with paths filling space between paths of two other elements is called 'content elements'.

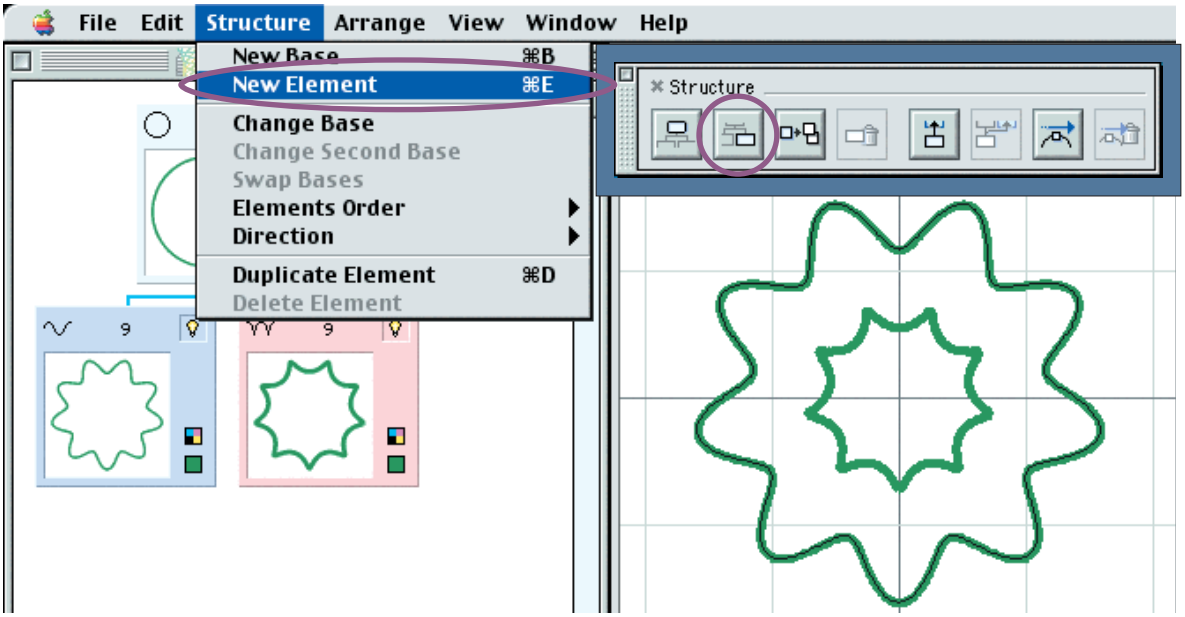
Content elements could be located on the second and deeper levels of the tree structure. They have two black connection lines, that lead to their two parent objects. The path of content element is enclosed by the paths of these two parent objects.



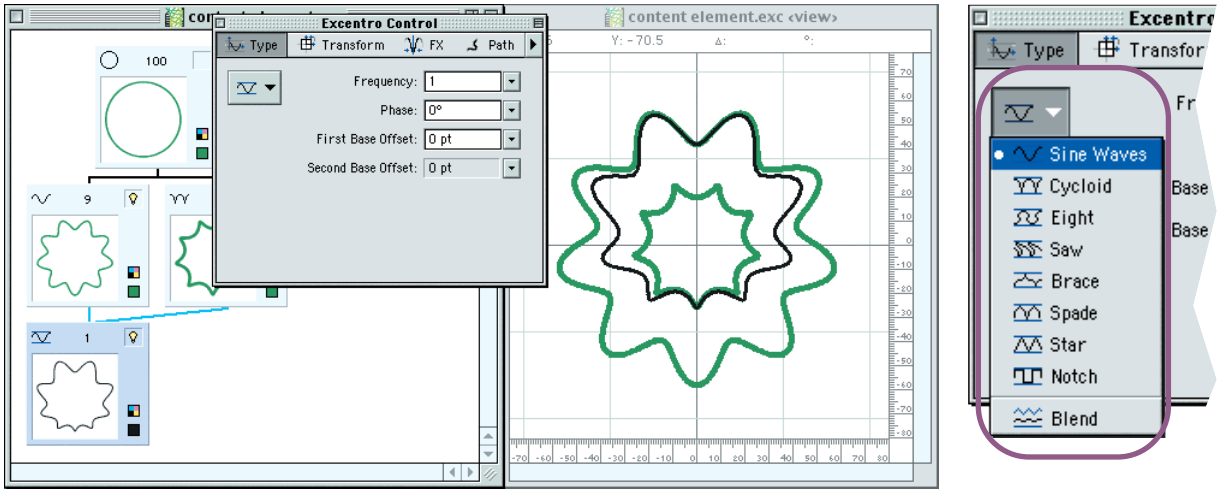
Objects of any type (base objects, other regular elements and content elements) can serve as parent objects for new content elements. Considered from the 'tabletop-sheet-pencil' mechanical model point of view, paths of content elements are created by 'pencil' moving between two paths of its parent elements. As with the regular elements, there are several types of regular elements with each type defining its own specific shape that 'pencil' draws between parent paths.

Very often content elements are used to create vector texture that adds 'flesh' to the 'skeleton' formed by base objects and regular elements to finalize the guilloche design of a rosette or a border.

■ **Creating Content Elements.** To create new content element you should select two existing elements of tree structure. The first element should be selected with plain mouse click on its representation in main document window, the second element should be selected with shift-click, that is: you should press **Shift** modifier key on the keyboard and holding it down click the representation of the second element. After two elements were selected choose **New Element (Cmd–E)** command from **Structure** menu or its shortcut button in **Toolbar**.

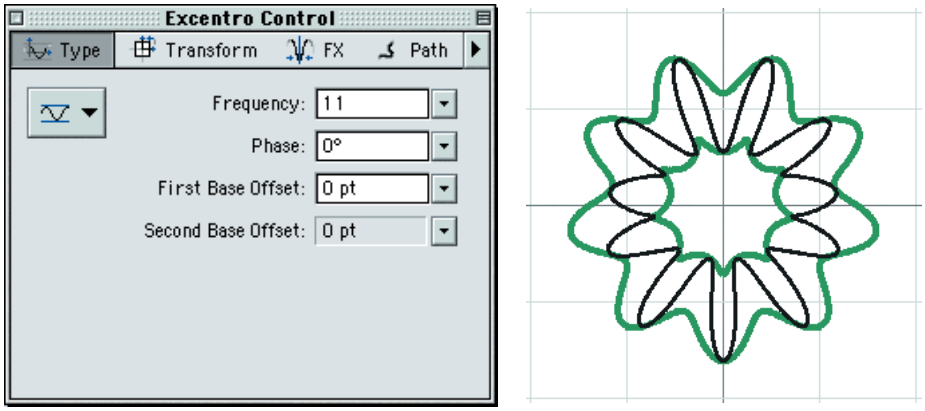


New content element will be added to the tree structure below the first selected element. Two black connection lines will appear between new content element and its two parents. Default shape of the path for a new content element is a wave with one swell (**Frequency** = '*1*'). You can change it using **Type** pop-up menu and attribute fields from **Type** panel of **Excentro Control** inspector.

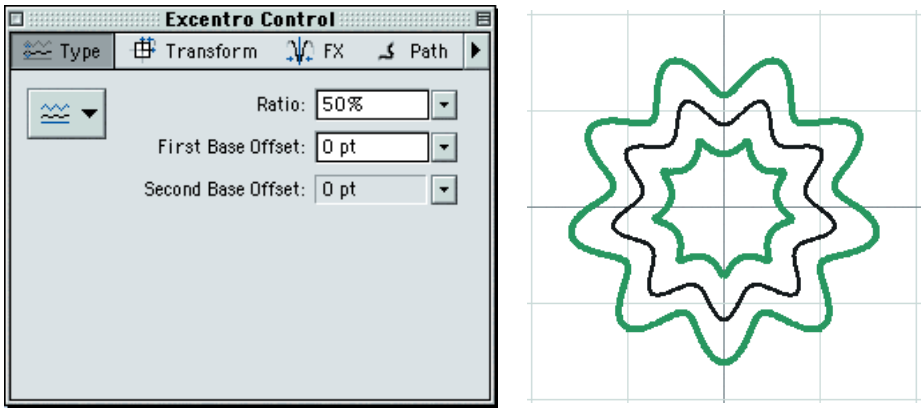


■ **Types of Content Elements.** Two most frequently used types of content elements are **Sine Wave** and **Blend**:

◆ The content elements of **Sine Wave** type have wavy shapes with number of swells controlled by **Frequency** attribute. Starting position of the swells is set by **Phase** attribute value. **First Base Offset** and **Second Base Offset** attributes defines the distance from the swells of waves to two paths of parent objects.



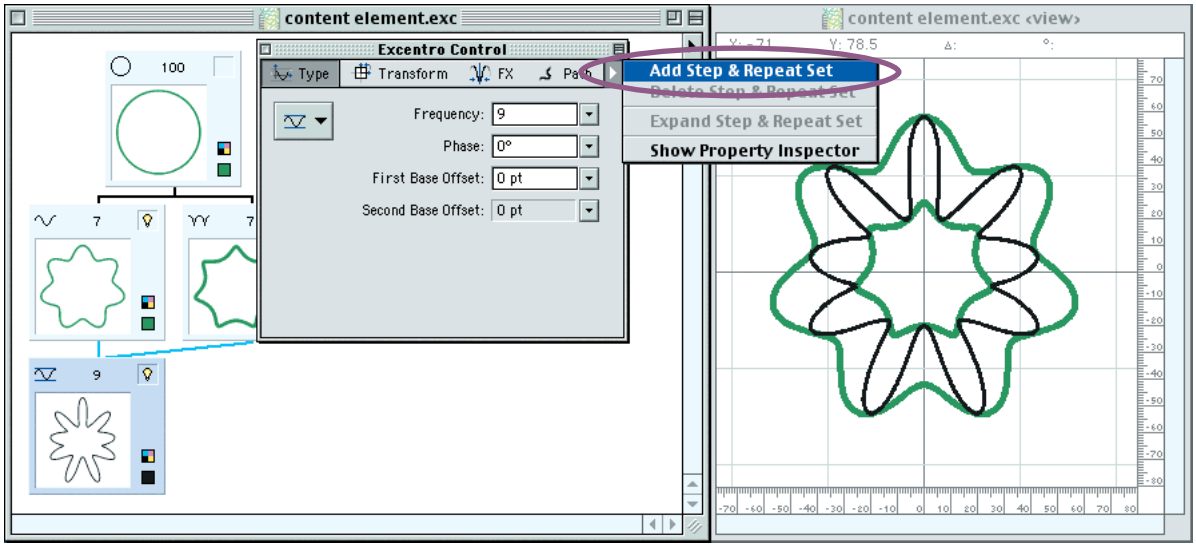
◆ The content elements of **Blend** type have one significant attribute — **Ratio**. This attribute defines the shape of the content element and distance from its path to two paths of its parent objects. Value '*0%*' sets the path of **Blend** content element to be identical to that of its first parent object, value '*100%*' — to that of its second parent object, value '*50%*' — to middle line between paths of two parent objects.



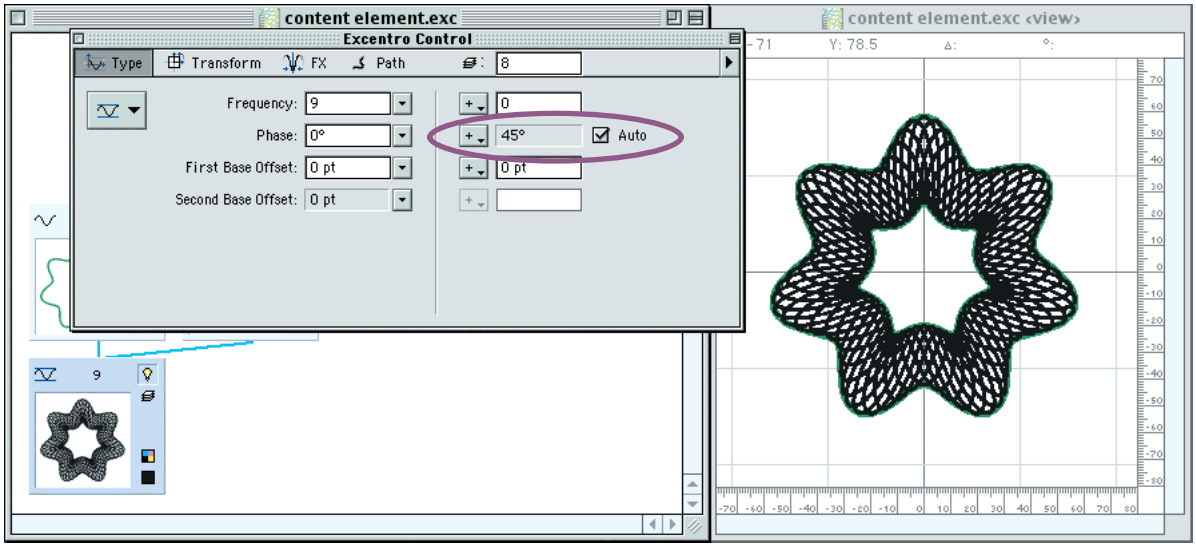
You can find the detailed illustrated description of all content elements types and their attributes in **Excentro Objects Reference** book. Here we just mention again that to create new content elements you should select two other existing elements in the tree structure and choose **New Element** command. To create vector texture of content elements that uniformly fills the space between paths of its parent objects you should use Step & Repeat Sets feature of *Excentro* application (see next section below).

STEP AND REPEAT SETS

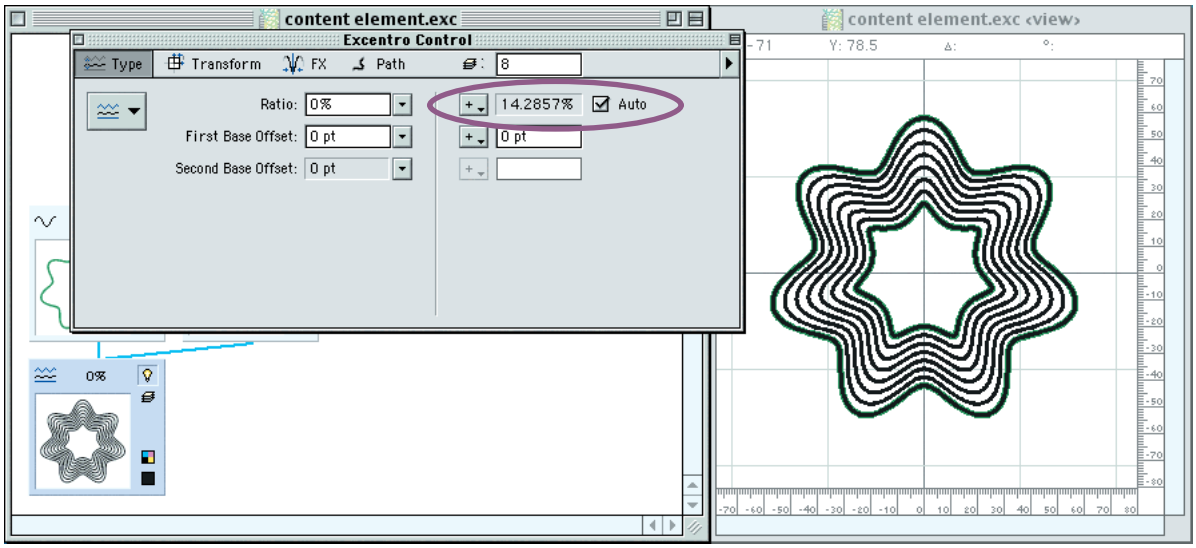
Objects of content elements class are often accompanied by Step & Repeat Sets. This *Excentro* feature allows you to create quickly additional copies of object's path with some or all attributes modifications. To add Step & Repeat Set to the selected object choose **Add Step & Repeat Set** command from **Excentro Control** inspector's window menu (button with triangle in right top corner of the window):



The window of **Excentro Control** inspector will expand to accommodate new fields. The numeric field in top area (with the 'pile' icon beside it) is called **Number of Steps**. It defines how many paths this Step & Repeat Set produces (including the original path of the object). Fields below it are **Increment** fields. They modify appropriate attribute values in left part of **Excentro Control**.

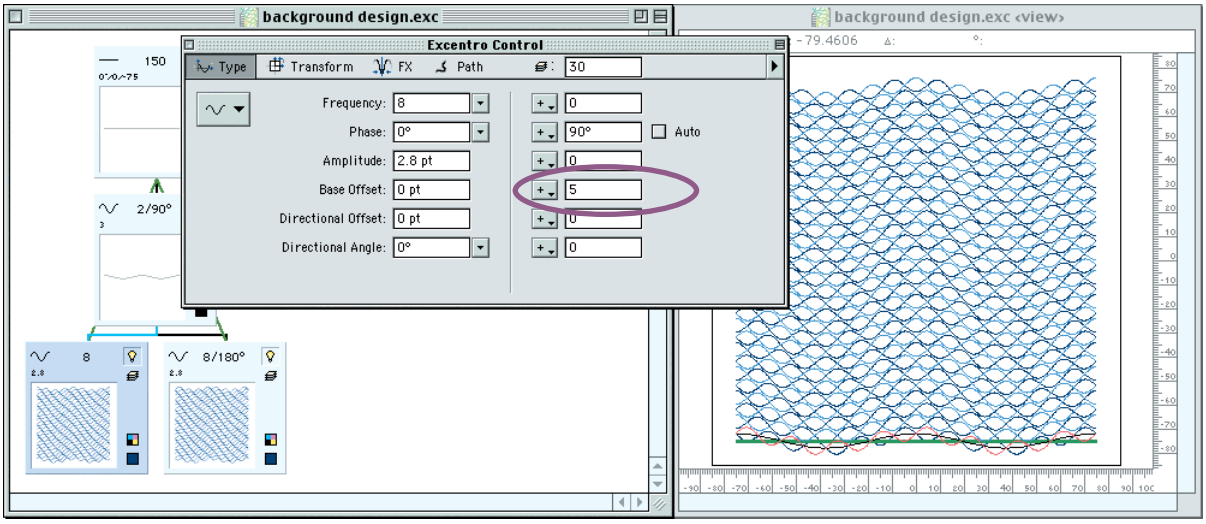


To create vector texture of content elements that uniformly fills the space between paths of its parent objects for the content element of **Sine Wave** type you can enter desired number of paths into **Number of Steps** field, then click **Auto** checkbox beside **Increment** field for **Phase** attribute (see the previous picture). To create vector texture for the content element of **Blend** type you should first set its **Ratio** attribute to *'0%'* value, then enter desired number of paths into **Number of Steps** field and click **Auto** checkbox beside **Increment** field for **Ratio** field.



Step & Repeat Set adds increment value to current value of the modified attribute at every step (number of steps is defined by **Number of Steps** field) thus creating new copies of the path with slightly different attribute values.

Creation of vector texture for content elements is not the only application of Step & Repeat Sets feature. Another popular usage for this feature can be found during linear backgrounds creation, when Step & Repeat Sets create additional copies of the paths by modify vertical or horizontal offset attributes.

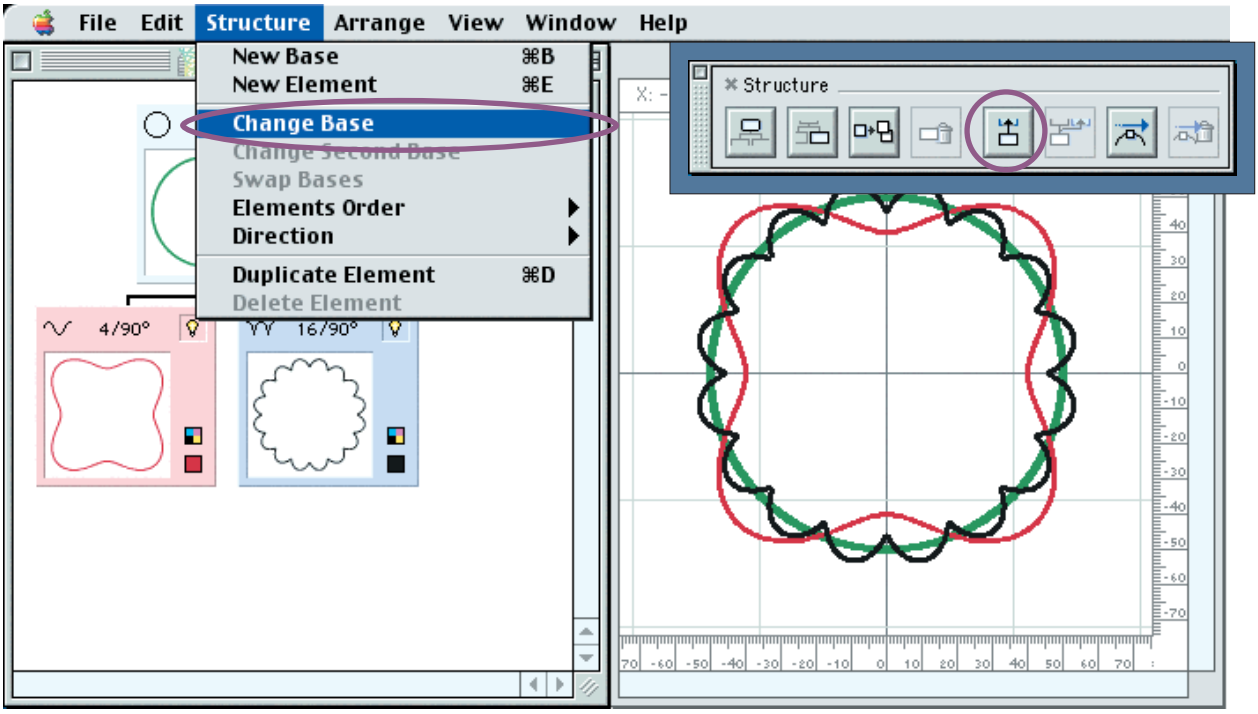


You can add more than one Step & Repeat Set to single object of guilloche tree or use different types of **Increments**. Detailed description of this feature and Step & Repeat Set fields of **Excentro Control** inspector could be found in **Excentro Control** chapter of **Excentro Windows Reference** book.

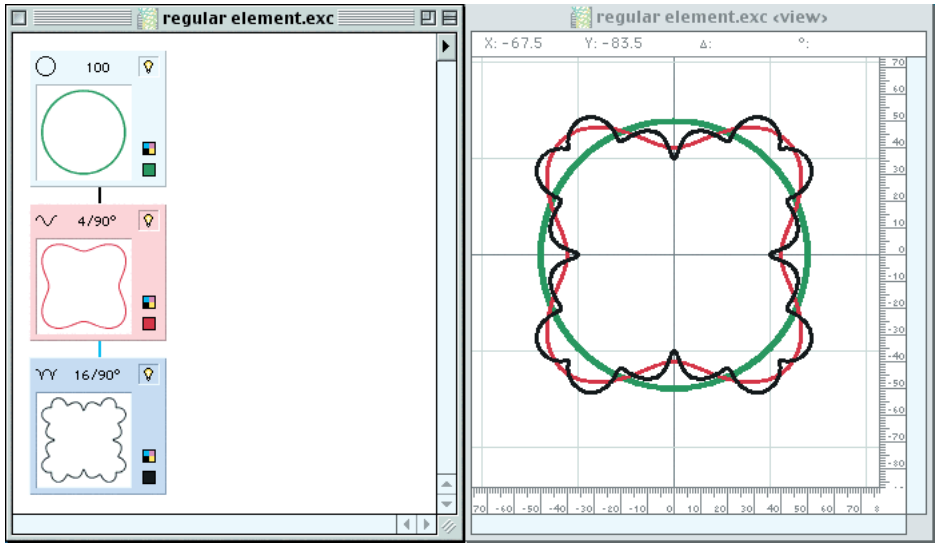
MODIFYING GUILLOCHE DESIGN STRUCTURE

The tree structure of the guilloche design remains flexible even after its creation is finished. You can change parent objects connections, duplicate and delete elements of the structure at any convenient time.

To change the parent object of the selected element you should select with shift-click another element that you want to become its new parent (press **Shift** modifier key on the keyboard and holding it down click the representation of this element in main document window) and choose **Change Base** command from **Structure** menu or its shortcut button in **Toolbar**.



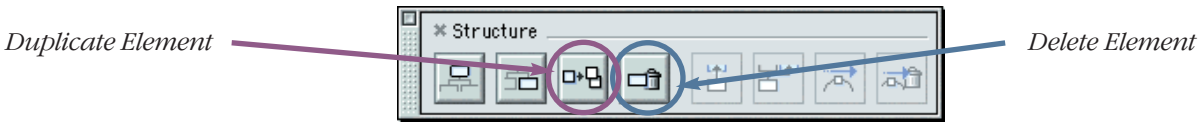
Child-parent relations of tree structure will be updated and the graphics in document preview window will change accordingly:



In the similar way **Change Second Base** command of **Structure** menu allows you to modify the second parent element of the selected content element.

To duplicate the selected element of the tree structure you should use **Duplicate Element (Cmd–D)** command of **Structure** menu or its shortcut button in **Toolbar**. You can also use **Duplicate All Elements (Cmd–Shift–D)** to duplicate the selected element and all its child elements.

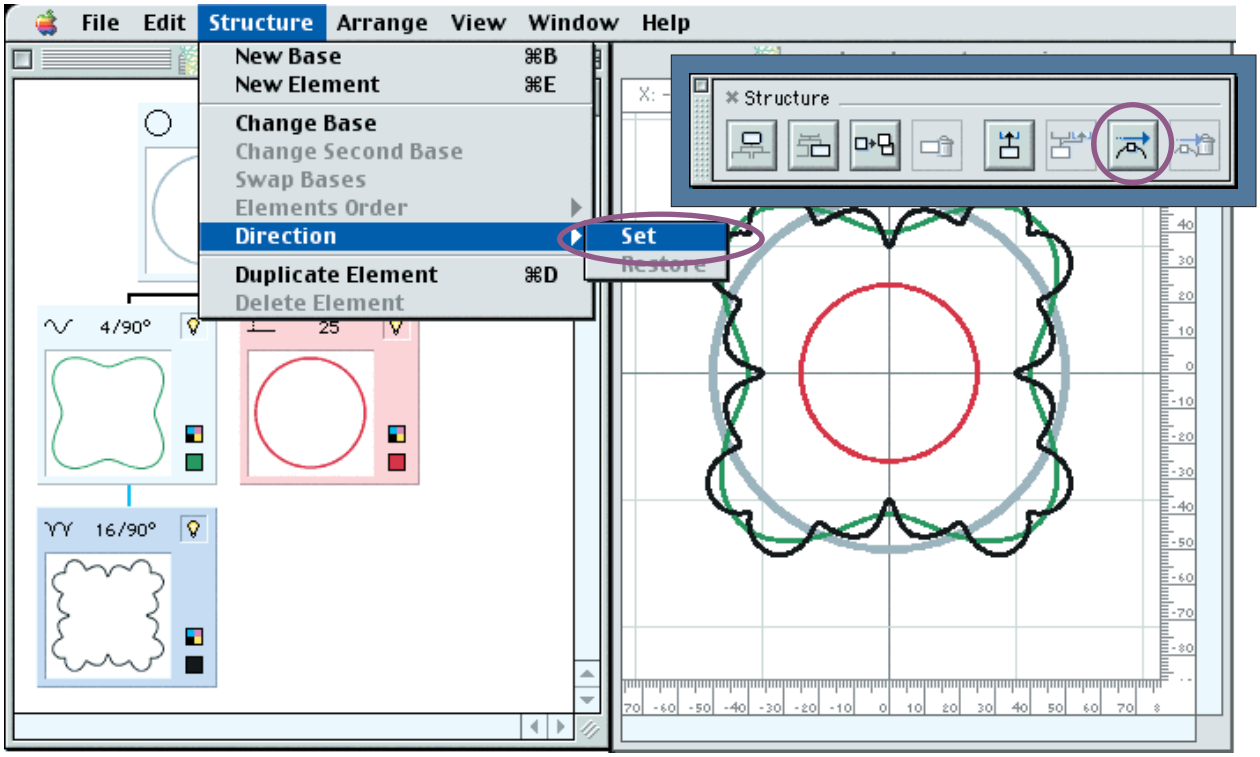
To delete the selected element you can use **Delete Element** command of **Structure** menu or its shortcut button in **Toolbar** (this element should not have child elements or other elements depending on it). There is also **Delete All Elements** command that is available in **Structure** menu if you will hold down **Shift** modifier key. With this command you can delete both the selected element and all its child elements.



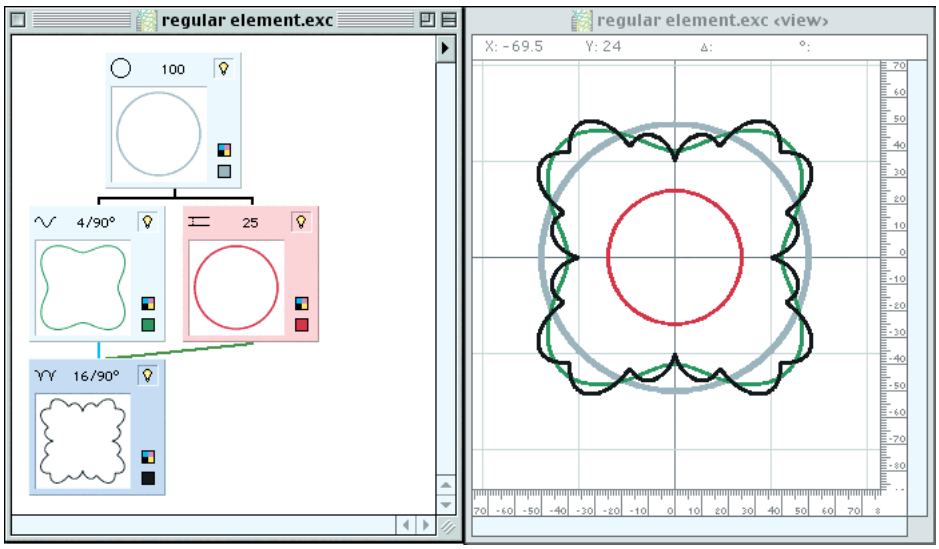
DIRECTION

The last issue we must cover in this chapter about guilloche tree structure construction are so called 'direction elements'. According to 'tabletop-sheet-pencil' mechanical model 'sheet' with 'pencil' in regular elements case not only moves along the path of its parent object on 'tabletop' but rotates together with tangent direction to this path. So the path of parent element's path 'guides dirction' of 'sheet' travel. You can change this behavior and set another element's path to guide 'sheet's' direction to avoid path breaks and unwanted coils.

To set another element to guide direction of the selected regular element you should select this another element with shift-click (press **Shift** modifier key on the keyboard and holding it down click the representation of the element in main document window) and choose **Set** command from **Direction** submenu of **Structure** menu or its shortcut button in **Toolbar**.



New green connection line will appear between the selected regular element and its new direction element. The graphics in document preview window will change accordingly to this change:



PART II: EXCENTRO TUTORIALS

CHAPTER 1: CREATING DOCUMENTS WITH GUILLOCHE DESIGNS

This chapter of **Using Excentro** guide illustrates a typical work procedure within *Excentro* and *Adobe Illustrator* applications that you could follow to create standard certificates or diploma. We will not discuss details of actual guilloche design work: creation of borders, rosettes and backgrounds. You will find these tutorials in other chapters of this guide. Instead, we will focus on overall procedure.

We will show all the steps from original concept creation and design composition in *Excentro* application to few additional steps required to prepare the finished document for output in *Adobe Illustrator* application. We will compose our sample certificate document using ready borders, rosettes, backgrounds examples from '**Excentro Templates**' folder. You can use your own templates and elements in place of these, or create borders, rosettes and backgrounds from scratch.

You are not required to follow all these steps very closely, this is just an illustration for novice users that helps to understand the basic idea of what you can do with *Excentro* and how to prepare a finished document for print in *Adobe Illustrator*. After you became an advanced *Excentro* user you can change order of these steps or choose another work procedure that suits you most.

CONCEPT CREATION

Just like with any other application or software graphics tool, before actually starting to work on brand new document you should decide what exactly you would like to do.

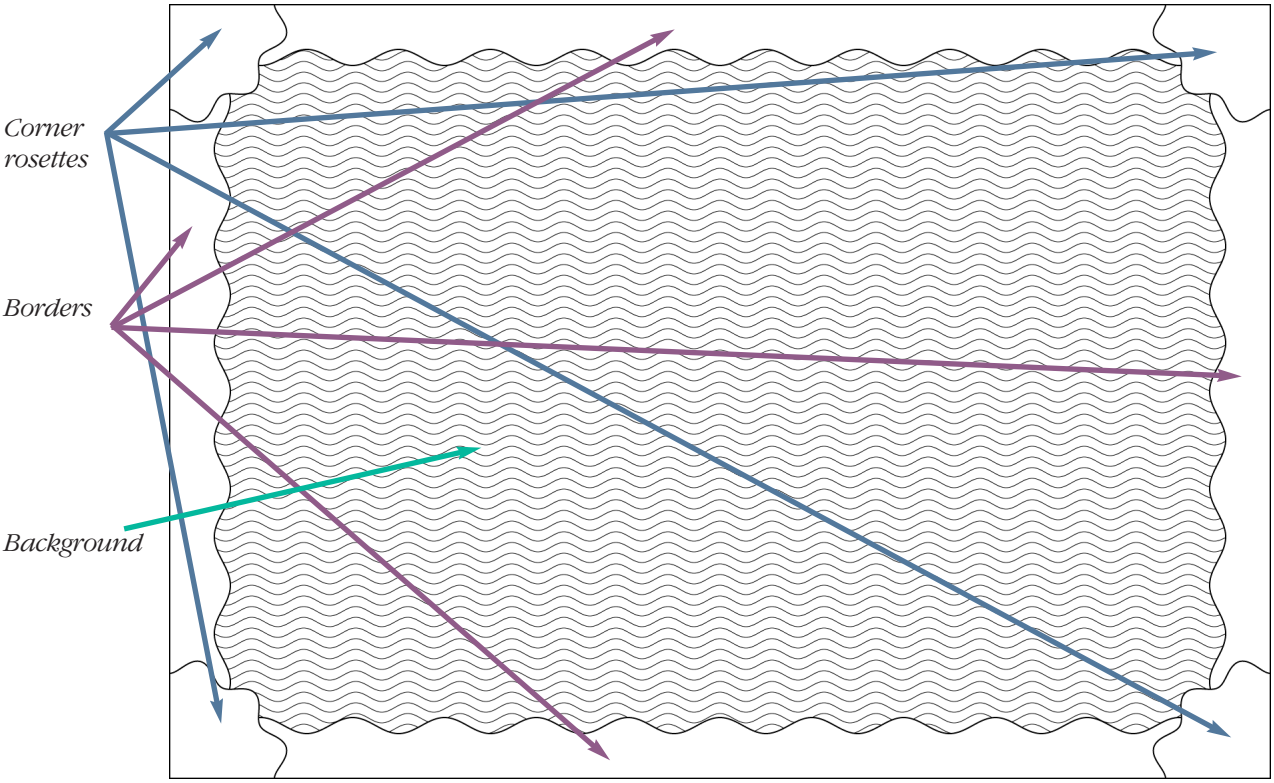
■ **Step 1: Document Type and Size.** As the first initial step you should decide what type of document you would like to create: certificate, diploma, lottery ticket, banknote, plastic card, etc. You should choose right size for this document: standard A4 or other ISO predefined size, or, maybe, some custom document format.

◆ For this chapter example we will create a typical certificate of ISO A4 size that will fit a standard frame of same size, that could be found in any photo or office supplies shop.

■ **Step 2: Document Composition.** The next step would be to define number and type of guilloche parts (rosettes, borders, backgrounds) that will be used in the document. You should also try to estimate roughly geometric sizes of these elements. For example: "*the document will have four linear borders that run along its frame and have height of 1.5 centimeters (0.6 inches)...*".

It would help if you will find a sheet of paper of right size and will try to draw a sketch of the future document with a pen or a pencil. This draft drawing will help you later 'to stay on right course' during the document creation, and not to be distracted by different objects of computer interface. You can add as many details to rosettes and borders shapes to the sketch as you find helpful.

◆ Our A4 certificate will have 'classic' look with four linear borders that will form the document frame, four rosette segments in the corners and single background of linear kind. The height of the borders will be about 1.5 centimeters, the radius of the rosettes will be twice as high, so that they cover the corners of the borders. Preliminary sketch of this document is shown on the following page:



■ **Step 3: Document Colors and Stroke Weights.** The last step of the document concept creation would be to choose colors and stroke weights for guilloche paths. These attributes depend mostly on the printing technology that will be employed to print the document.

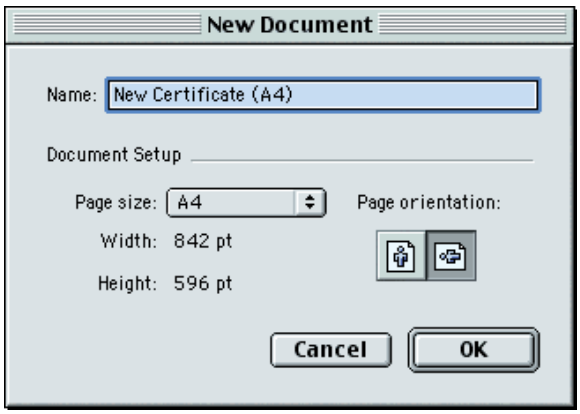
You should know beforehand if the document destined to be printed on traditional offset (litho) printing press, on special gravure/intaglio equipment, on flexographic press, on digital press or on common office laser printer. For traditional graphic arts technology you can use any available spot colors with paths thickness as small as 0.15–0.3 points (40–80 microns) since most of Computer-to-Plate and Computer-to-Film output devices have resolution of 2400 dpi or higher. For digital printing devices it is a bit more complicated because most of them these days have resolution of no more than 600 dpi and are capable to print path strokes only with weight of 0.3–0.4 pt (90–110 microns) or higher. To avoid problems with screening on these digital printing devices you should print with spot colors (if special inks and toners are available) or use process colors with relatively high C, M, Y, K densities.

◆ Our sample document will be prepared for printing on standard offset printing press. We will use paths with stroke weight no higher than 0.25 pt (70 microns). Guilloche graphics will use only two colors that should be printed with spot inks: **Color 1** — 'blue' color with process approximation '*C = 100%, M = 100%*' (that could be printed with PANTONE 2685C, for example); and **Color 2** — 'orange' color with process approximation '*M = 50%, Y = 100%*' (that could be printed with PANTONE 152C). Text will be printed using standard black process ink from the last printing unit or as the additional pass (after the guilloche graphics impression was already printed as the first pass).

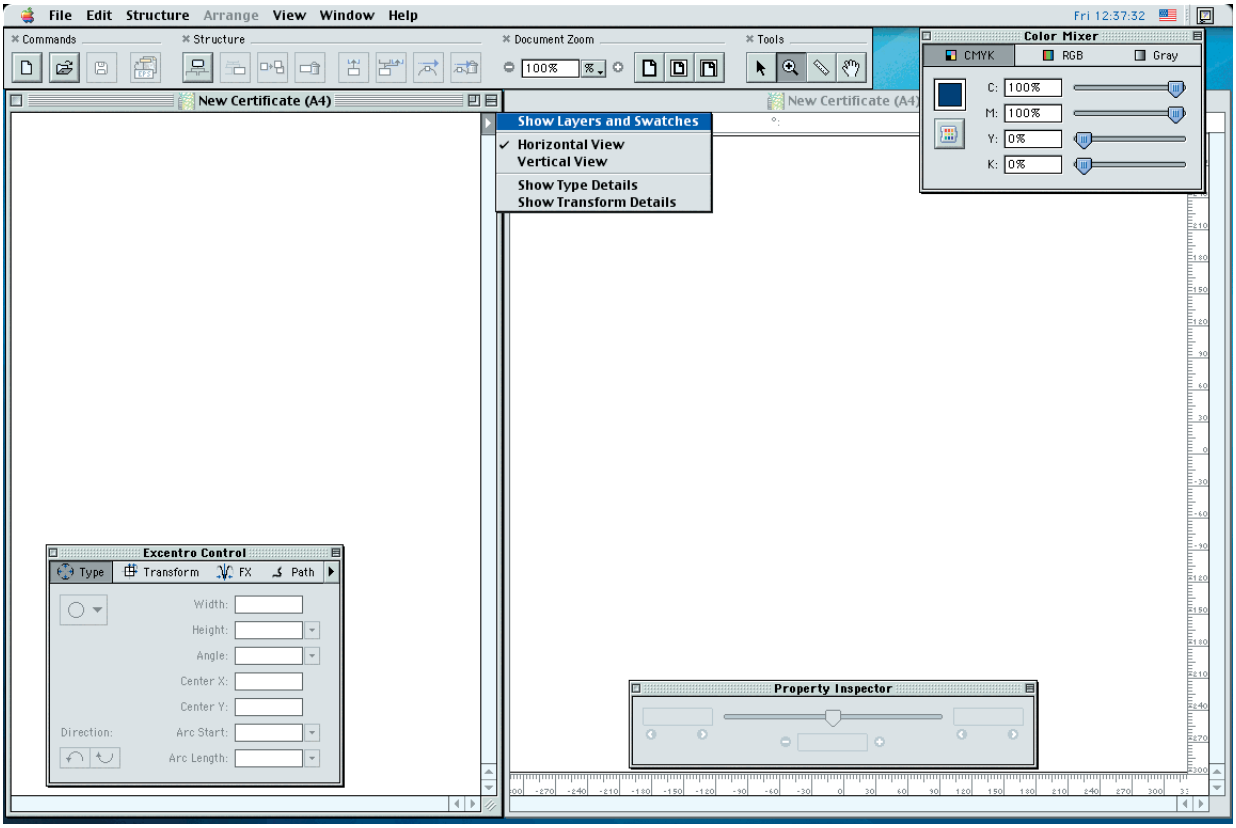
DOCUMENT DESIGN AND COMPOSITION IN EXCENTRO

After you decided on document design conception issues, it is time to launch *Excentro* application and do the main part of the work. The first step of this part would be to create new document, the final step — to export the ready document with all graphics elements in *Adobe Illustrator* file format.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Choose proper page size that suits your document: either select predefined document size from pop-up menu or enter custom size in **Width** and **Height** fields. In our example we are creating standard A4 size certificate, so, select '*A4*' from the pop-up menu and click '*Landscape*' orientation button.



Click **OK** button and two windows of new document will appear in front of you. Our document will be multi-layered work with borders, rosettes and background designs placed on different layers in the document. You can open layers and colors panes of main document window at this moment by choosing **Show Layers and Colors** command from main document window menu.

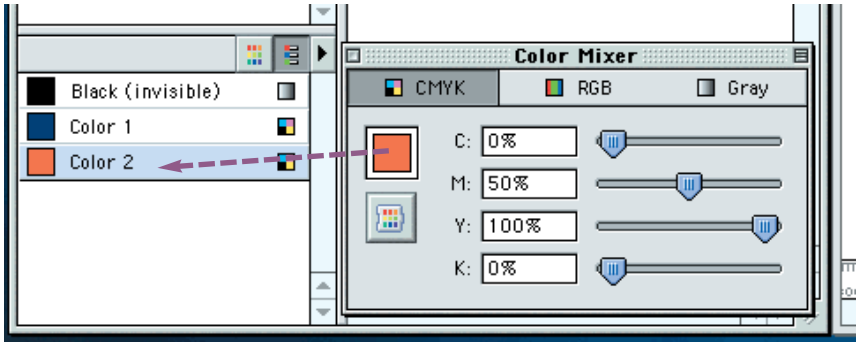


■ **Step 2: Document Colors List.** We already decided that we will print our certificate graphics using only two colors (inks). Let us add these colors to the document colors list. To reduce confusion, you can first delete all unwanted colors from the list by choosing **Delete All Unused** command from colors list pop-up menu. After that add three colors to the list by dragging patches from **Color Well** control of **Color Mixer** inspector:

◆ The first color will be plain black color that will be used for invisible base paths and skeleton bones, so these paths will not be confused with visible (printable) graphics.

◆ The second color will be the 'blue' **Color 1** (you can also drag appropriate spot color right from PANTONE palette.

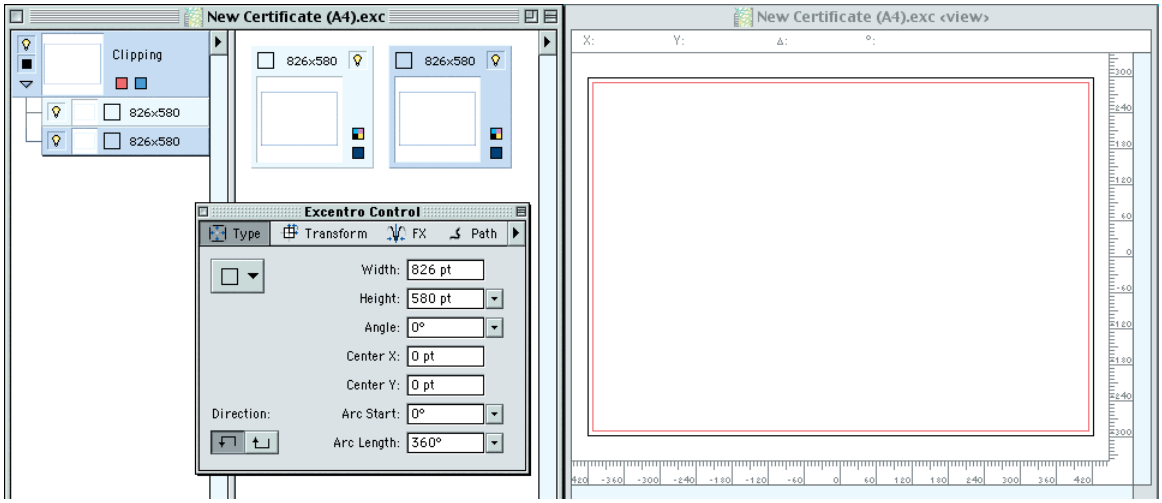
◆ The third color will be the 'orange' **Color 2** (and you can also take it from the spot colors palette).



■ **Step 3: Clipping Frame Layer.** Usually certificates are put into wooden or plastic frames from everyday office supplies of photo shops and placed on a shelf or a wall where everyone can see them. To make this 'framing' possible the certificate graphics should have slightly smaller size comparing to standard A4 size of the frame. For example, it can have margins 8 points wide on each side. To visually limit actual graphics area for future work let us create top layer in our document that will contain only rectangular path of proper size.

Choose **New Base** command from **Structure** menu to create new base object. Select '*Rectangle*' from **Type** pop-up. Enter attribute values: **Width** = '*826 pt*', **Height** = '*580 pt*'. Make this path of 'blue' **Color 1** color with **Stroke** = '*2 pt*'.

We will use a copy of this rectangular path later in *Adobe Illustrator* as a clipping mask to cut off unwanted areas of the artwork. To create a copy choose **Duplicate** command from **Structure** menu.

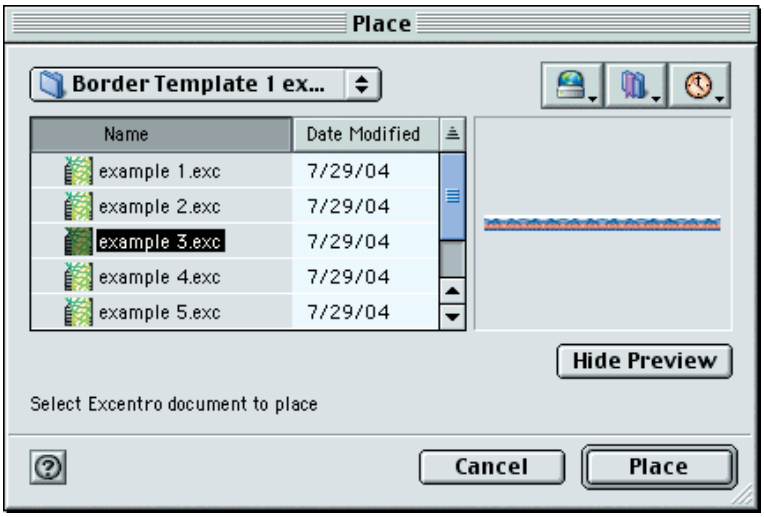


■ **Step 4: Bottom Border.** Starting with this step we begin to create guilloche graphics content of our document. Let us start with the linear border that runs along the bottom of the certificate.

Create new layer in the document with **New Layer** command from the layers list pop-up menu, then drag this layer below the first layer (the one with rectangular frame).

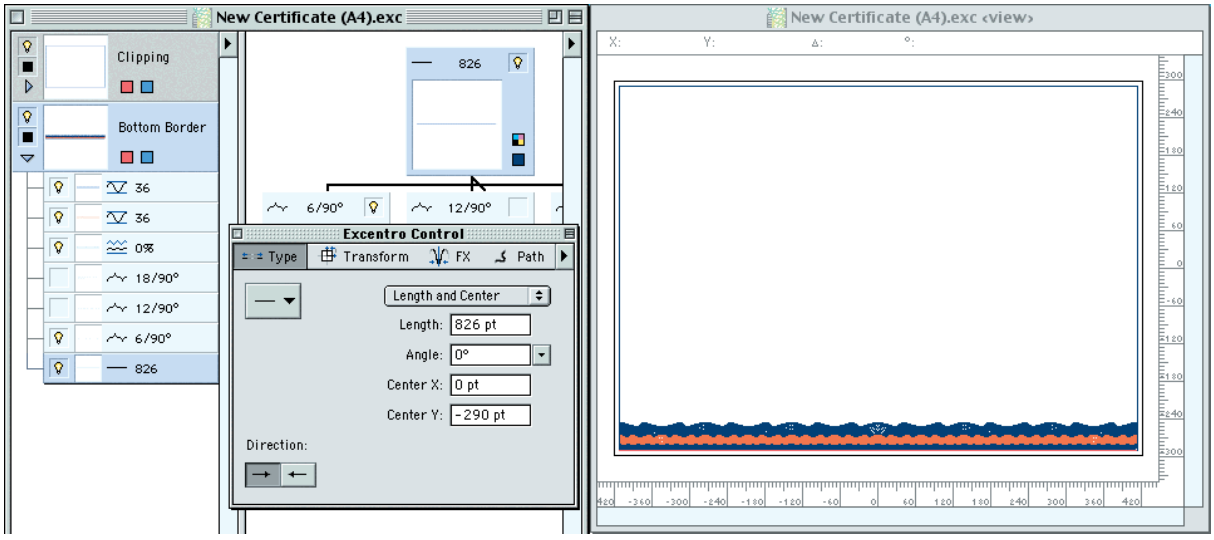
You can create bottom border as a completely new guilloche design, starting with **New Base** command, then adding skeleton paths and content elements. The process of linear border creation is covered in details in another chapter of **Using Excentro** guide. For this chapter purposes we will use ready guilloche designs from '**Excentro Templates**' folder instead.

You can add graphics from ready template and library files either by using **Place** command from **File** menu or by dragging layers and objects from one opened document to another. Choose **Place** command from **File** menu and navigate to '**example 3.exc**' file from '**Border Template 1 examples**' folder. Click **Place** button and graphics from this file will be added to the document.



Since this is a bottom border, we should move new graphics to bottom position in the document. To do so, select **Line** base object that is the root object of the guilloche tree and modify its attributes: **Width** = '*826 pt*' (to resize the border to our document's graphics content width), **Center Y** = '*–290 pt*' (bottom position).

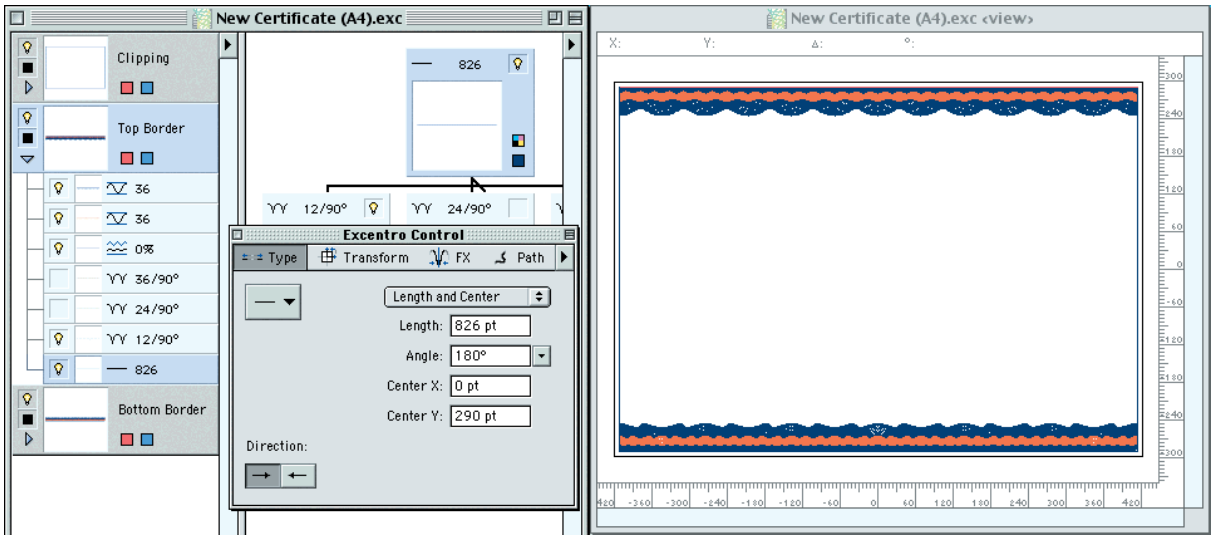
Check colors and stroke weights of new border graphics paths to make them all use only three previously defined colors of our certificate.



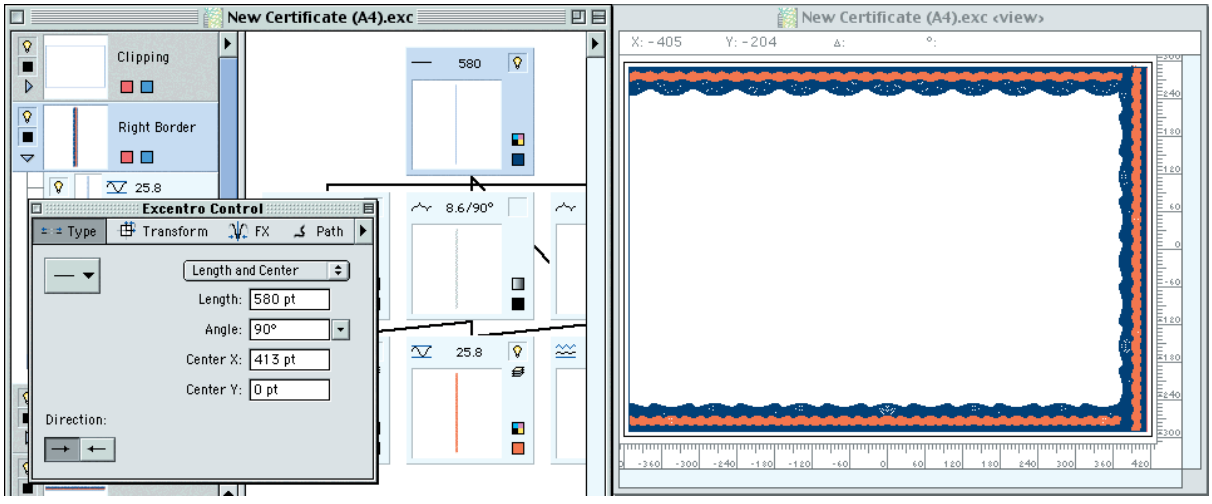
■ **Step 5: Top Border.** Let us create the top border of our certificate in the similar manner as the bottom border. Create new layer then place to it graphics from '**example 1.exc**' file from '**Border Template 1 examples**' folder.

Move new graphics to top position in the document by modifying attributes of its **Line** base object: **Width** = '*826 pt*' (to resize the border to our document's width), **Center Y** = '*290 pt*' (top position), **Angle** = '*180°*' (to rotate the border design upside down).

Check colors of new guilloche graphics paths to make them all use only three previously defined colors of our certificate.



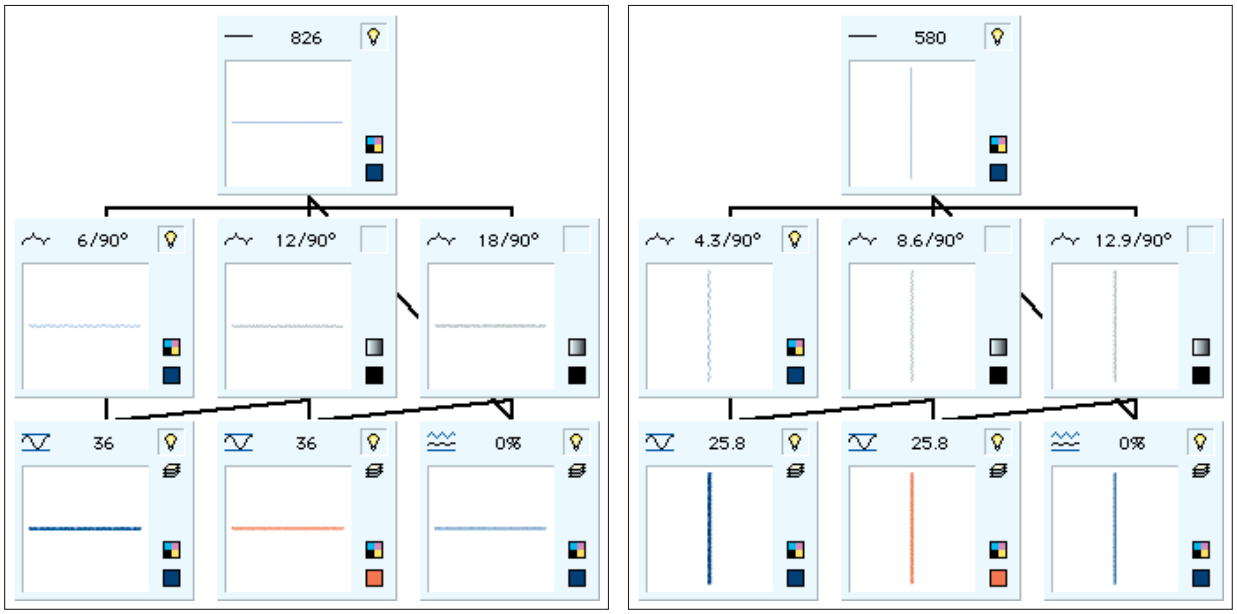
■ **Step 6: Right Border.** We will make the shape of the right border resemble that of the bottom border. Duplicate the layer with the bottom border design. Move new graphics to right side of the document by modifying attributes of its **Line** base object: **Width** = '*580 pt*' (to resize the border to our document's height), **Center X** = '*413 pt*' (right position), **Center Y** = '*0 pt*' (center position), **Angle** = '*90°*' (to rotate the border design counterclockwise).



Because length of the right border is shorter than that of the bottom one, let us modify **Frequency** attributes of its skeleton paths proportionally. Set **Frequency** of the first **Brace** regular element to '*4.3*', **Frequency** of the second **Brace** element to '*8.6*' and **Frequency** of the third **Brace** element to '*12.9*'.

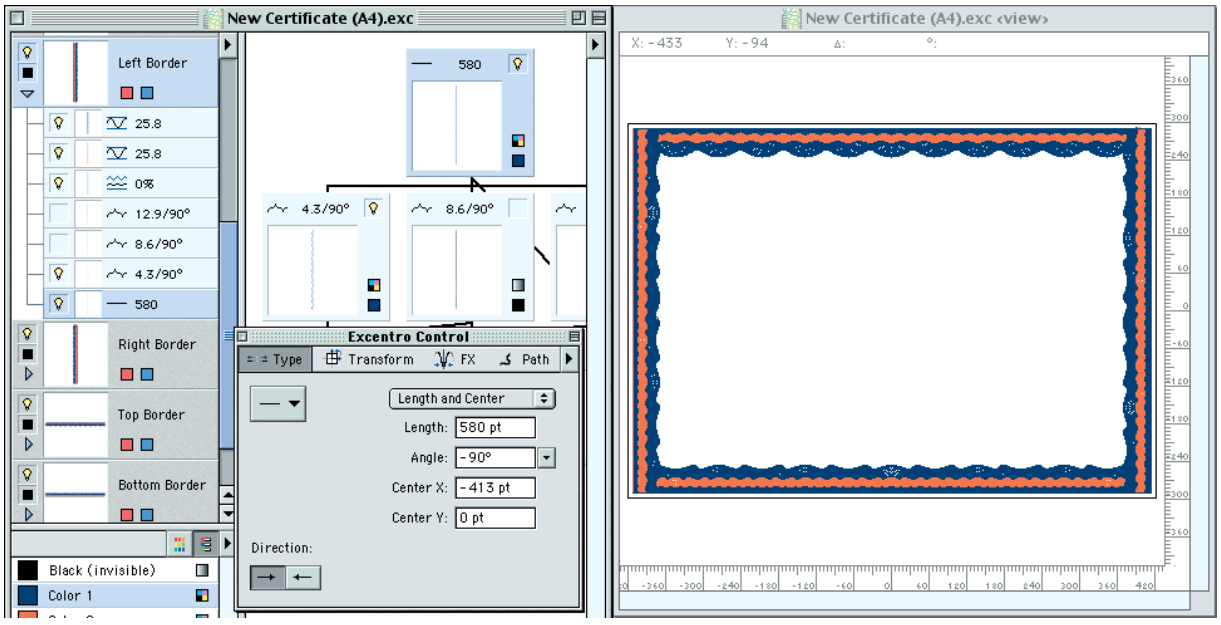
Set **Frequency** attributes of **Sine Wave** content elements to '*25.8*' to make 'paths density' of the right border and of the bottom border more consistent.

You can compare guilloche tree and attributes of the bottom border design (left picture) with that of the right border design (right picture):



■ **Step 7: Left Border.** Let us create the left border design by duplicating the already existing right border and placing this new copy to the right part of the document with 180° rotation.

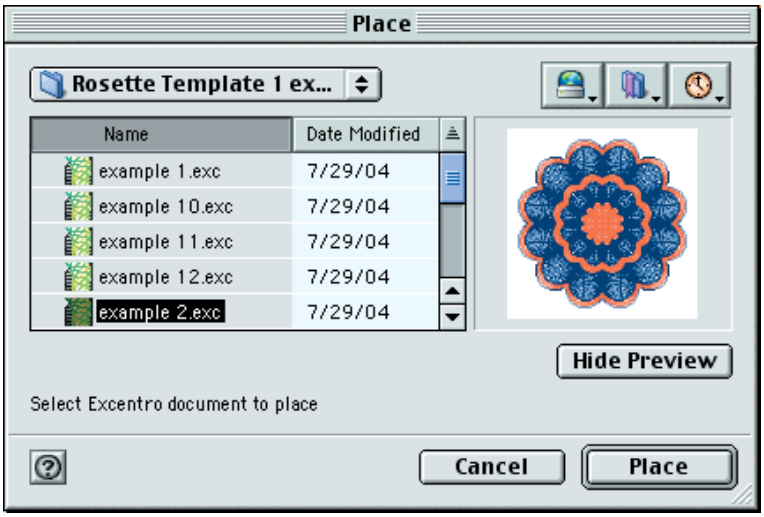
Duplicate the layer with the right border design. Move new graphics to the left side of the document by modifying attributes of its **Line** base object: **Center X** = '*–413 pt*' (left position), **Angle** = '*–90°*' (to rotate the border design by 180° around its center). We could also reverse **Direction** attribute, instead of modifying **Angle** attribute with the same effect



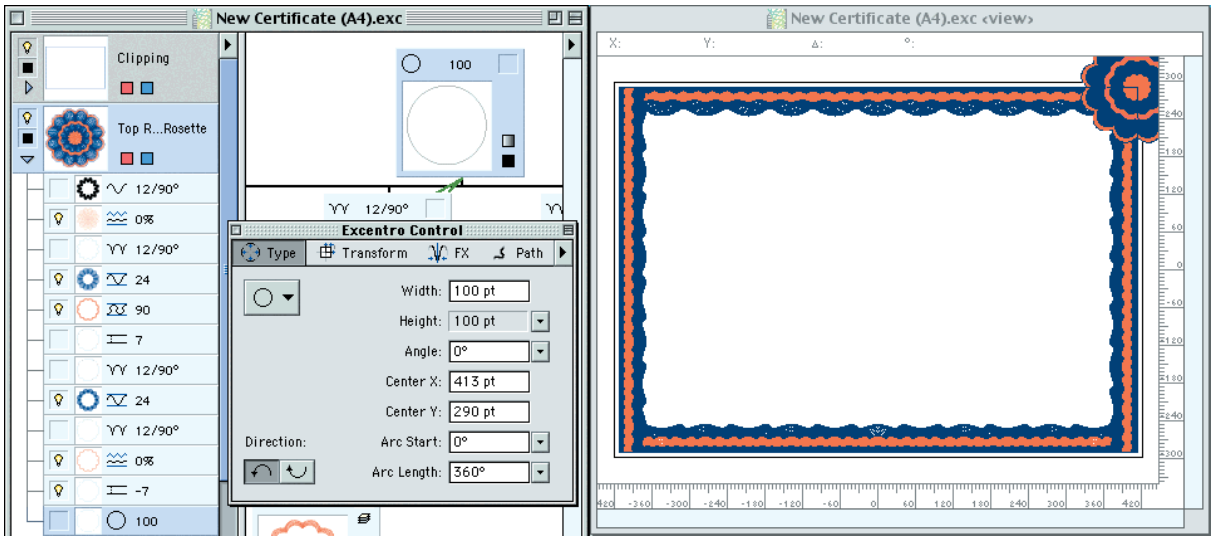
All the border designs are ready.

■ **Step 8: Top Right Corner Rosette.** Just like with the border designs, we will use ready examples from '**Excentro Templates**' folder to create rosettes in the certificate corners. This time we will use examples located in '**Rosette Template 1 examples**' folder of '**Excentro Templates**'. Detailed description of step by step rosette design creation could be found in rosettes tutorial chapter of this guide.

Create new layer in the document, then choose **Place** command from **File** menu and navigate to '**example 2.exc**' file in '**Rosette Template 1 examples**' folder. Click **Place** button and graphics from this file will be added to the document.

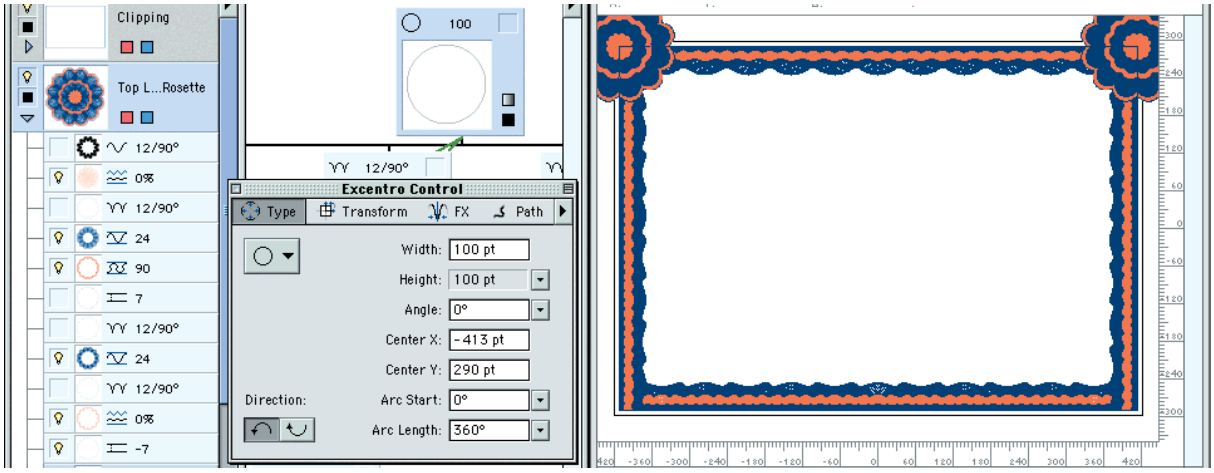


To move new rosette graphics to top right corner position select **Ellipse** base object that is the root object of this layer's guilloche tree and modify two of its attributes: **Center X** = '*413 pt*' (right position), **Center Y** = '*290 pt*' (bottom position).

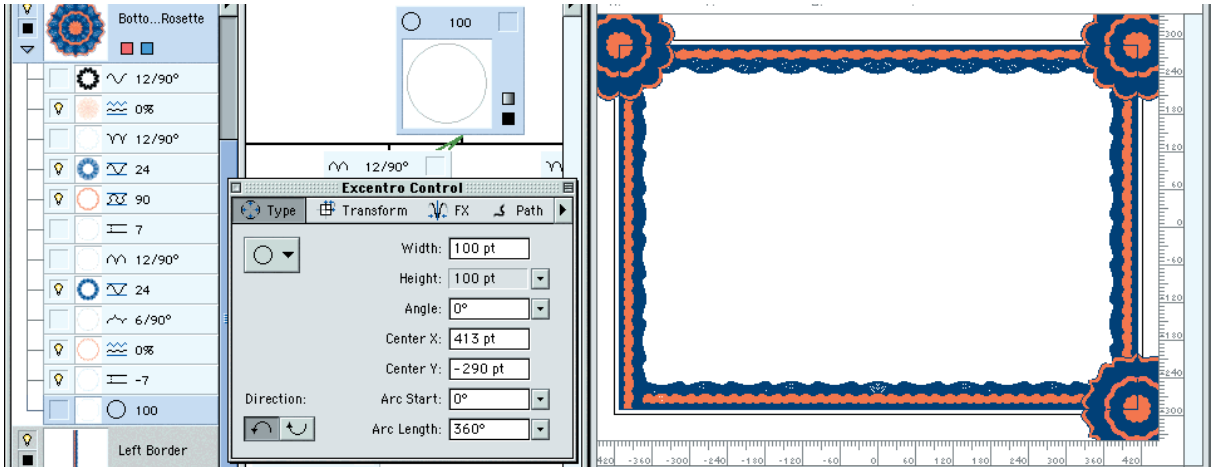


Check colors and stroke weights of just added graphics and make all the paths use only three colors of our certificate.

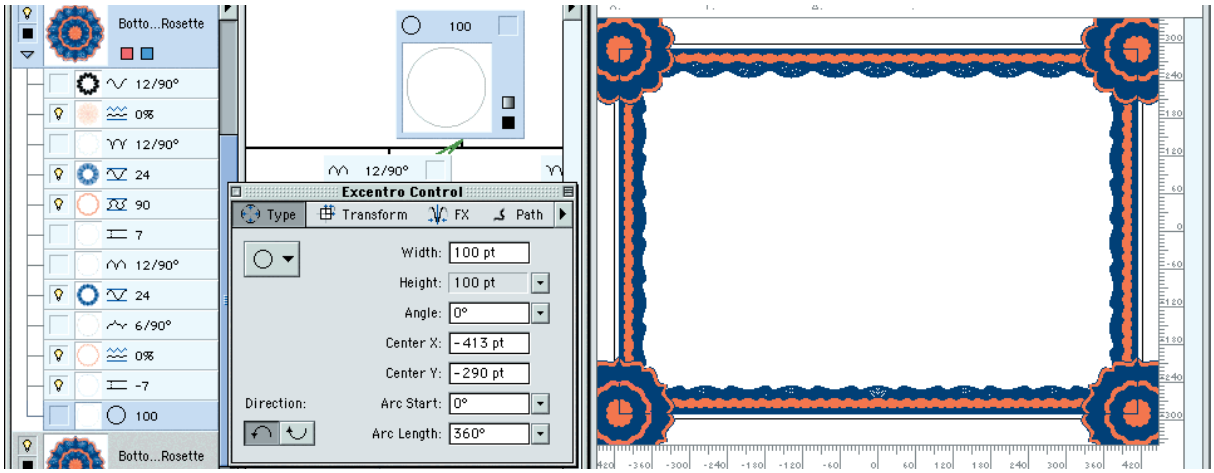
■ **Step 9: Top Left Corner Rosette.** This rosette will be a copy of the top right one, that was created in step above. Duplicate the layer with the top right corner rosette by choosing **Duplicate Layer** command from layers list pop-up menu. Move new graphics to top left position in the document by modifying **Center X** attribute of **Ellipse** base object: **Center X** = '*–413 pt*' (left position):



■ **Step 10: Bottom Right Corner Rosette.** Create new layer in the document, then place to this layer content of '**example 3.exc**' file from '**Rosette Template 1 examples**' folder. To move new rosette graphics to bottom right corner position in the document select **Ellipse** base object and modify two of its attributes: **Center X** = '*413 pt*' (right position), **Center Y** = '*–290 pt*' (bottom position). Check colors of new graphics.

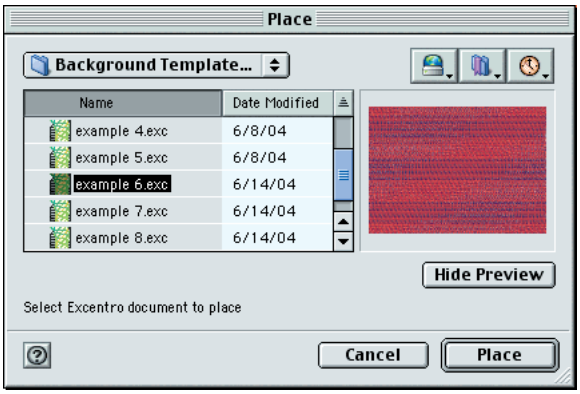


■ **Step 11: Bottom Left Corner Rosette.** Duplicate the layer with the bottom right corner rosette. Move new graphics to bottom left position by modifying **Center X** attribute of **Ellipse** base object: **Center X** = '*–413 pt*' (left position):

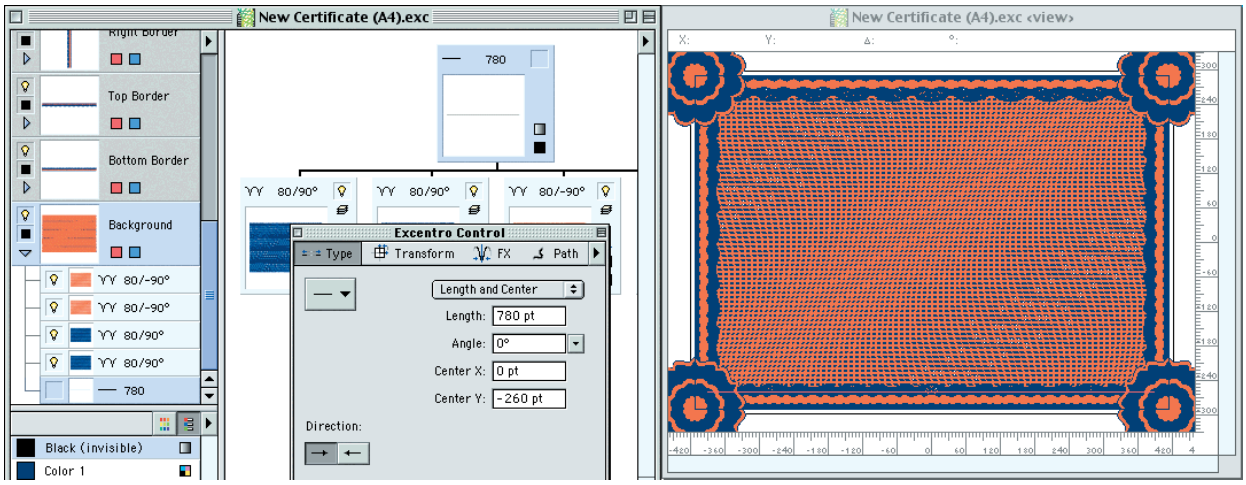


■ **Step 12: Background.** As the background of our certificate we will use graphics from '**example 6.exc**' file of '**Background Template 1 examples**' folder.

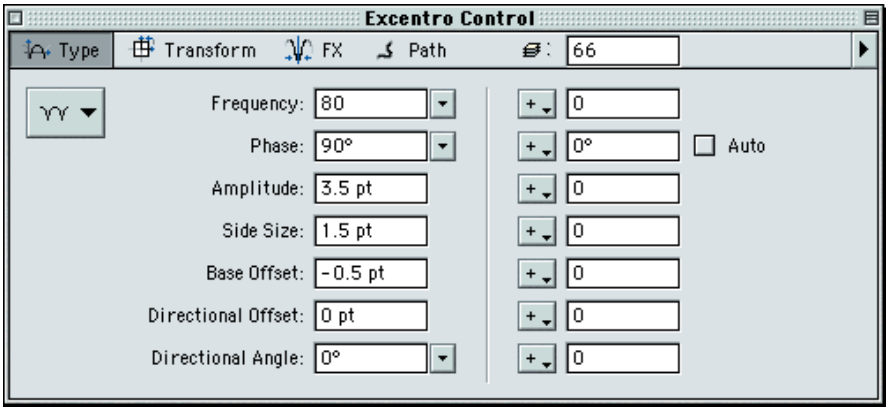
Create new layer in the document, then choose **Place** command from **File** menu and navigate to '**example 6.exc**' file in '**Background Template 1 examples**' folder. Click **Place** button and graphics from this file will be added to the document.



To move the background to proper position and resize it to our document's size select **Line** base object that is the root object of guilloche tree and modify two of its attributes: **Length** = '*780 pt*' (new background's size), **Center Y** = '*–260 pt*' (bottom position).



Now we should modify number of steps in Step & Repeat Sets of all the regular elements of the background, so that height of the background does not exceed that of the certificate. Select each of the regular elements and set number of steps attribute in their Step & Repeat Sets to '*66*':

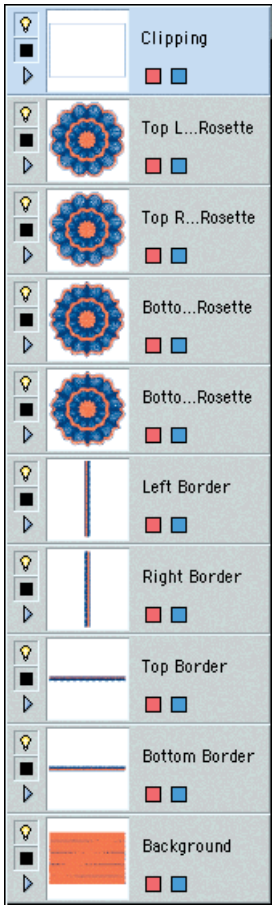


Check colors and stroke weights of the background graphics and make all the paths use only three colors used in our document.

■ **Step 13: Export Document in Adobe Illustrator format.** We finished our work with this document in *Excentro* application. Few final touches are left to do in *Adobe Illustrator* application before the certificate is ready to be printed.

Check that the document layers are sorted in the following order:

- **Layer 1: Clipping Frame —** the layer with two rectangle frames.
- **Layers 2 — 5: Corner Rosette** — the layers with four corner rosettes.
- **Layers 6 — 9: Linear Borders** — the layers with four border designs.
- **Layer 10: Background** — the layer with the background.

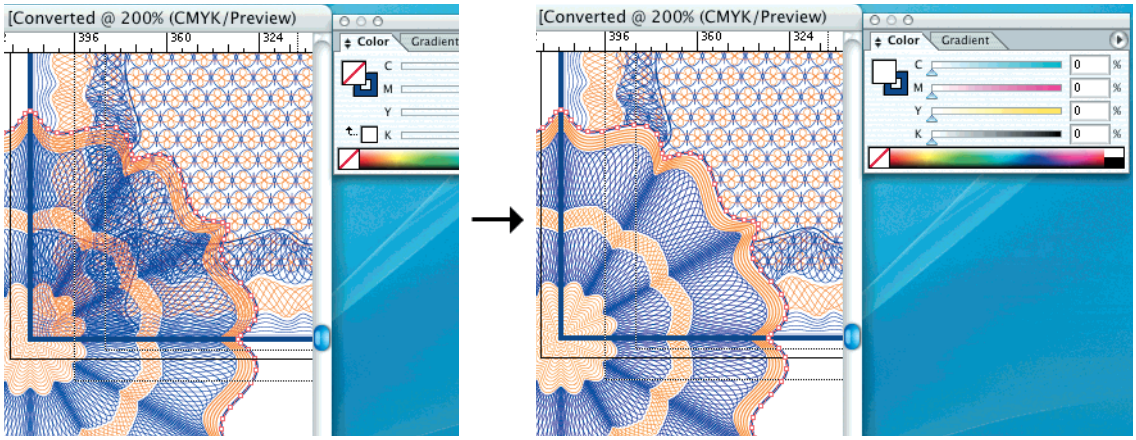


If the order is right, choose **Export** command from **File** menu and navigate to a proper local disk or a network file location. Click **Export** button to complete the operation and export the design in *Adobe Illustrator* format.

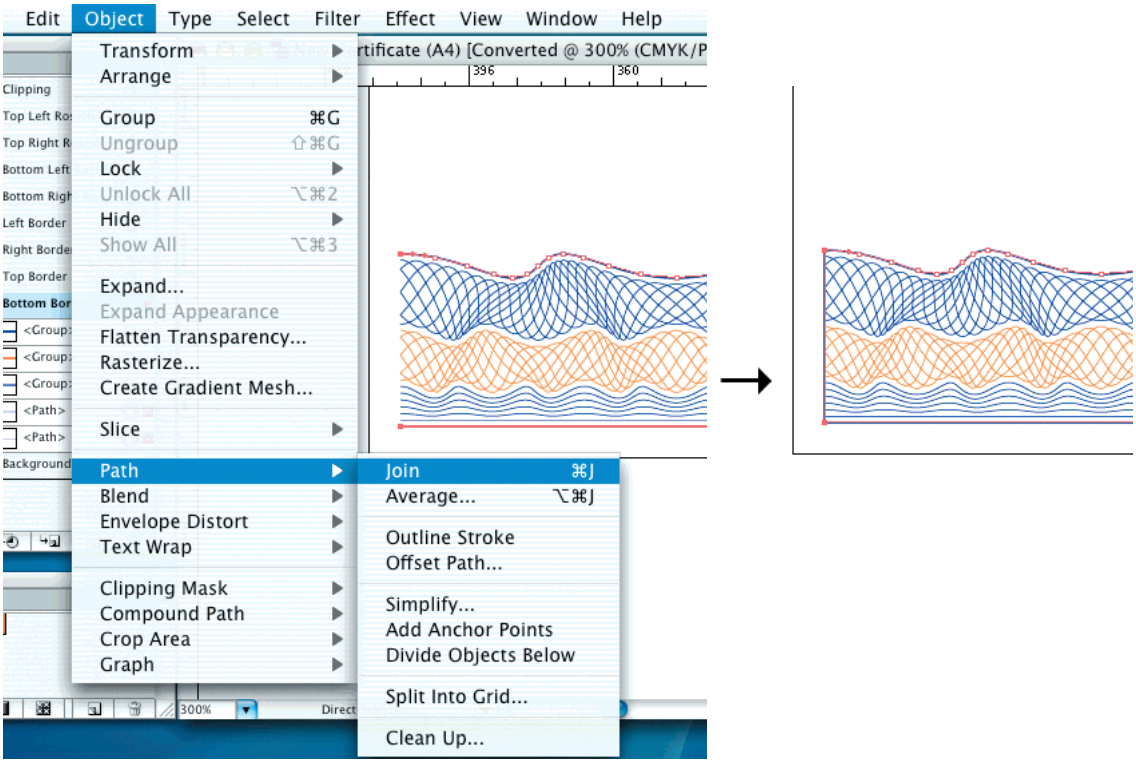
ADDITIONAL STEPS WITH ADOBE ILLUSTRATOR

Before our certificate is ready to be printed we should make several additional manipulations using *Adobe Illustrator* application and add the layer with the certificate title and text.

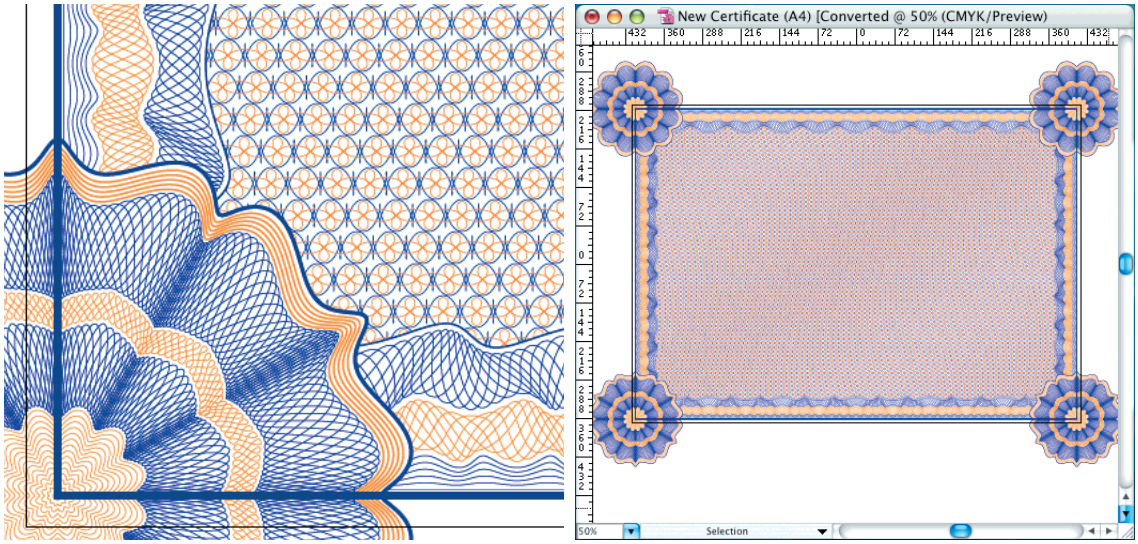
■ **Step 1: External Paths of Rosette Designs.** Open the exported file with *Adobe Illustrator* application. Select one after another all the paths that define outer border of the rosette designs and set **Fill** attribute of **Color** palette for these paths to 'white' color: '*C = 0%, M = 0%, Y = 0%, K = 0%*'. This will clip off the areas of border and background designs to the outer borders of the rosettes.



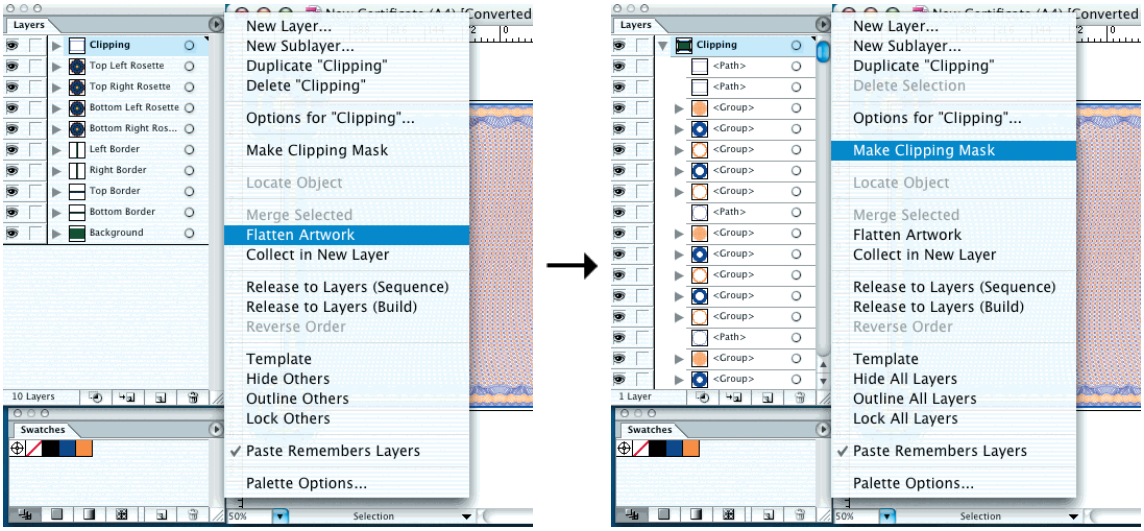
■ **Step 2: External Paths of Border Designs.** Next step would be to join endpoints of two paths that define shape of the border designs. You can do it with standard **Join** command from **Path** submenu of **Object** menu of *Adobe Illustrator*.

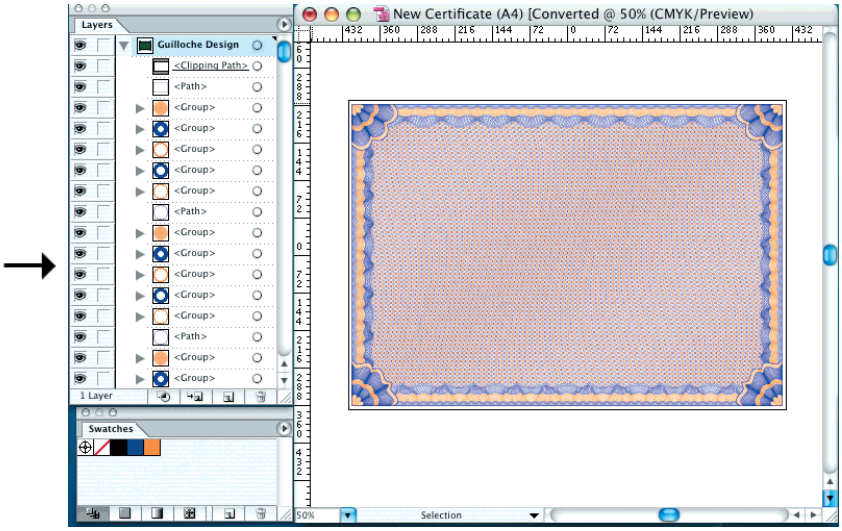


After that set **Fill** attribute of joined paths to 'white' color. This will clip off the areas of the background located beneath the border designs:

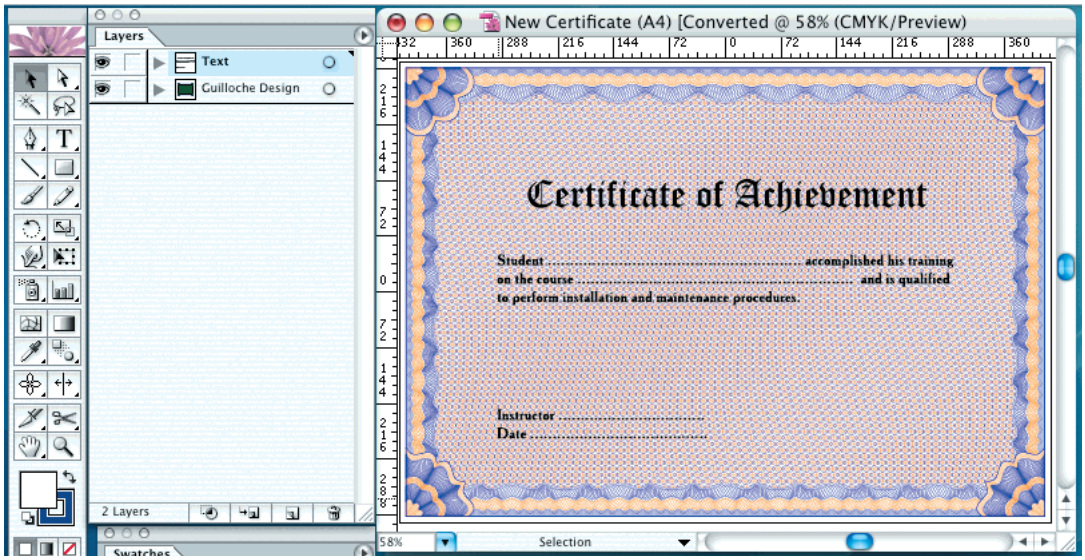


■ **Step 3: Clipping Mask.** To finish our work with the certificate graphics we have to clip off parts of the design that lies beyond the limits of rectangular frame in the first layer of the document. Merge all graphics layers in the document using **Flatten Artwork** command. After that create clipping region using **Make Clipping Mask** command.





■ **Step 4: Text Layer.** As the final step we should add some text in fancy typeface that describes the purpose of the certificate and informs onlooker why it hangs on this wall in important place.



Our certificate is ready to be printed, signed and handled to students...

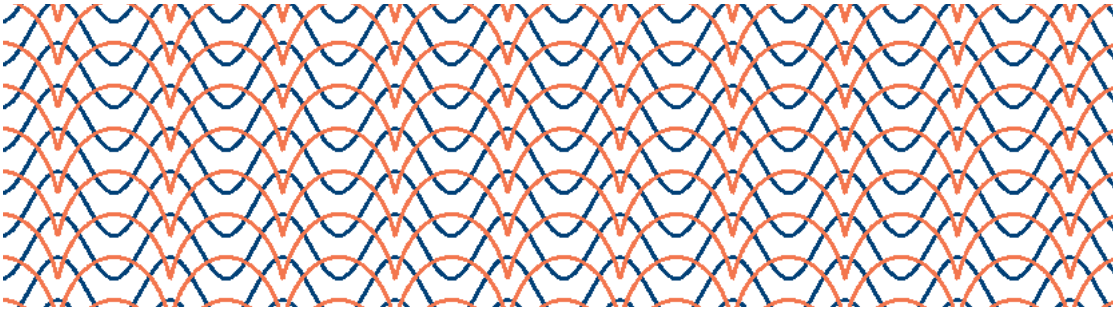
In conclusion let us show another image of the finished certificate design. You can compare it to the draft sketch on the first pages of this chapter and check if it is close enough. Unfortunately we can not place the image in vector form, because it will make the PDF file of this chapter too large for online distribution.

CHAPTER 2: LINEAR BACKGROUNDS

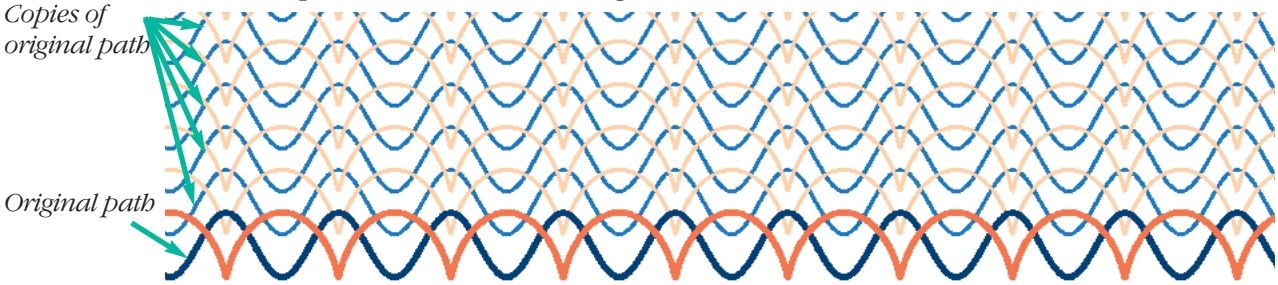
In this chapter we will give you an illustration how to create linear background patterns using only three *Excentro* objects: base of **Line** type and two regular elements. Example we will construct is the same as that of stationary file '**Background Template 1.exc**' from '**Excentro Templates**' folder. You can use this template to create new backgrounds by modifying attributes of its objects without a need to reconstruct them in new file following all steps described below.

CASE STUDY

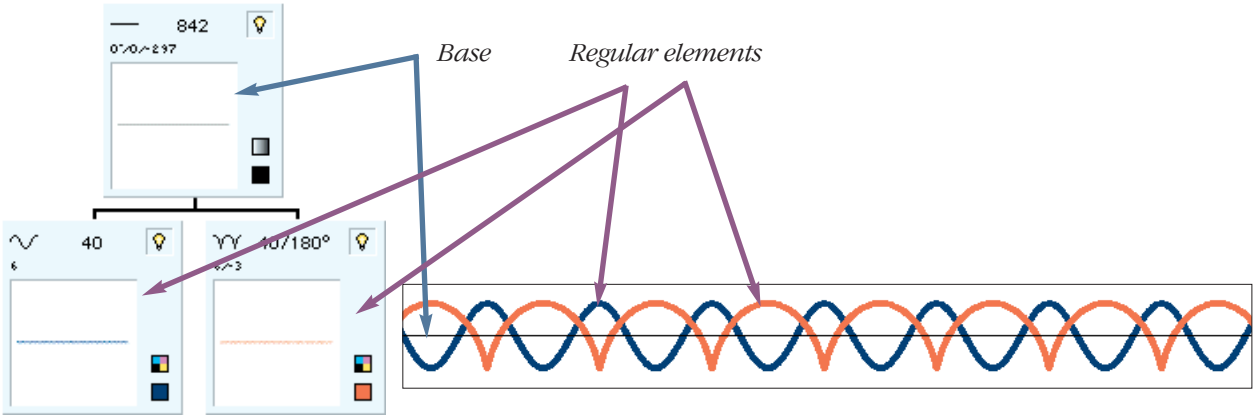
Classic linear backgrounds represent sets of intersecting wavy paths positioned one above another. Illustration below shows typical example:



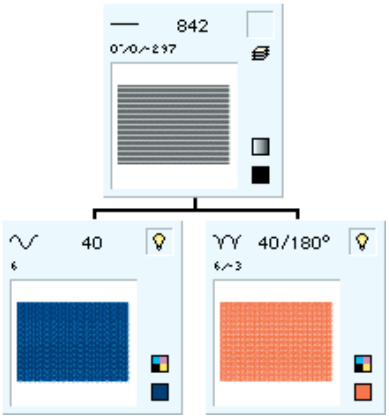
As you may see all wavy paths of same color on this picture are identical in shape. They are created by duplicating single path using same vertical offset value. To make a pattern like that we have to make two original paths of different shape and repeat them number of times required to fill desired background area.

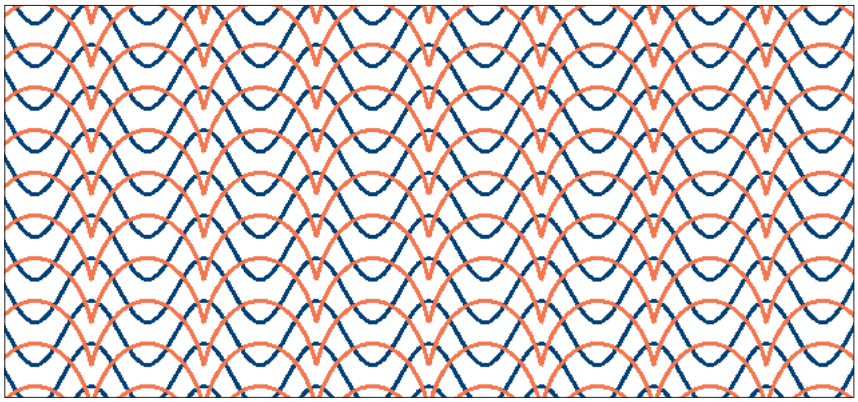


Because these two wavy original paths are linear, to create them we should use base object of **Line** type whose path will be made invisible at the end of the guilloche construction process (because it is not needed in final exported graphics file). Guilloche structure of the design with two intersecting wavy paths that use single linear base object can be not much different from one shown below:



When we have two original wavy paths ready, all is left to do to complete the background is to create their copies by applying Step & Repeat Set modifiers with small vertical offset value. It seems to be a wiser idea to apply Step & Repeat Set modifiers to **Line** base object: this will simultaneously modify both regular elements based on it, instead of applying two identical Step & Repeat Set modifiers to each of the regular elements. Guilloche structure of finished background is shown on following picture:

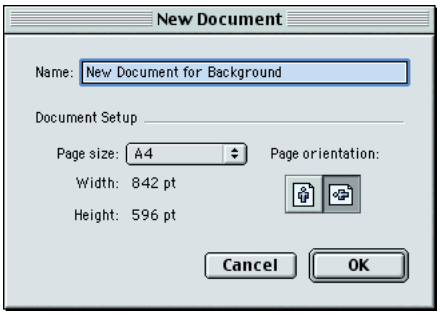




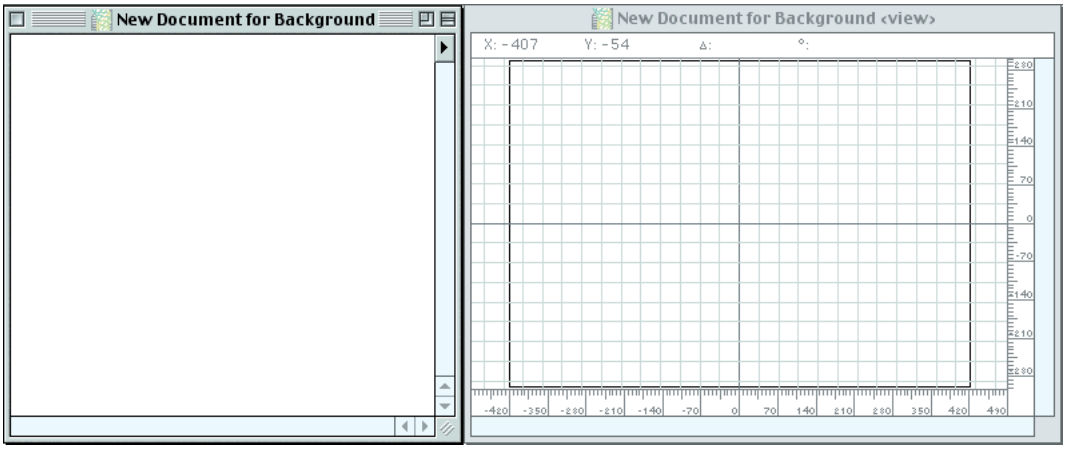
STEP BY STEP BACKGROUND CREATION

Below we provide detailed description of all steps required to create this background.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Select proper predefined document size from pop-up menu or enter custom size in **Width** and **Height** fields. To simplify work and graphics preview new document should have the same size as the background you want to create. In this example we will try to create background of '*A4*' size with '*Landscape*' orientation that could be used for standard diploma or certificate.



Click **OK** button and two windows of new document will appear in front of you.



■ **Step 2: Line Base Object.** Since we create 'linear' background we should create base object of **Line** type with **Length** equal to width of the document and position it in bottom part of the document.

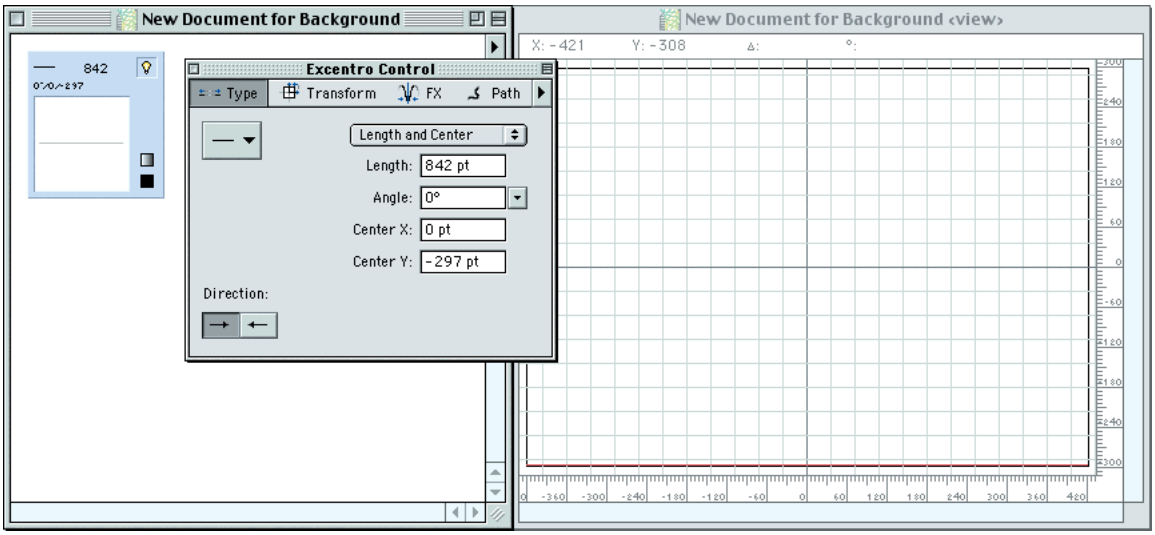
Choose **New Base** command from **Structure** menu to create new base object. After that in **Excentro Control** inspector choose following options:

- '*Line*' from **Type** pop-up menu
- '*Length and Center*' from Line options pop-up (it will be easier to control length of the line in case we will need to change document size later)

Enter following attributes in appropriate fields of **Excentro Control** inspector:

- **Length** = '*842 pt*' (full document width)
- **Angle** = '*0°*' (our line should be horizontal)
- **Center X** = '*0 pt*' (horizontal center of the document)
- **Center Y** = '*–297 pt*' (bottom position in the document)

Base creation is finished, you should get following picture on your screen (preview of base line is shown with red in document preview window because it is the selected object):



■ **Step 3: Regular Elements.** Now we shall create two wavy paths that will form texture of our background.

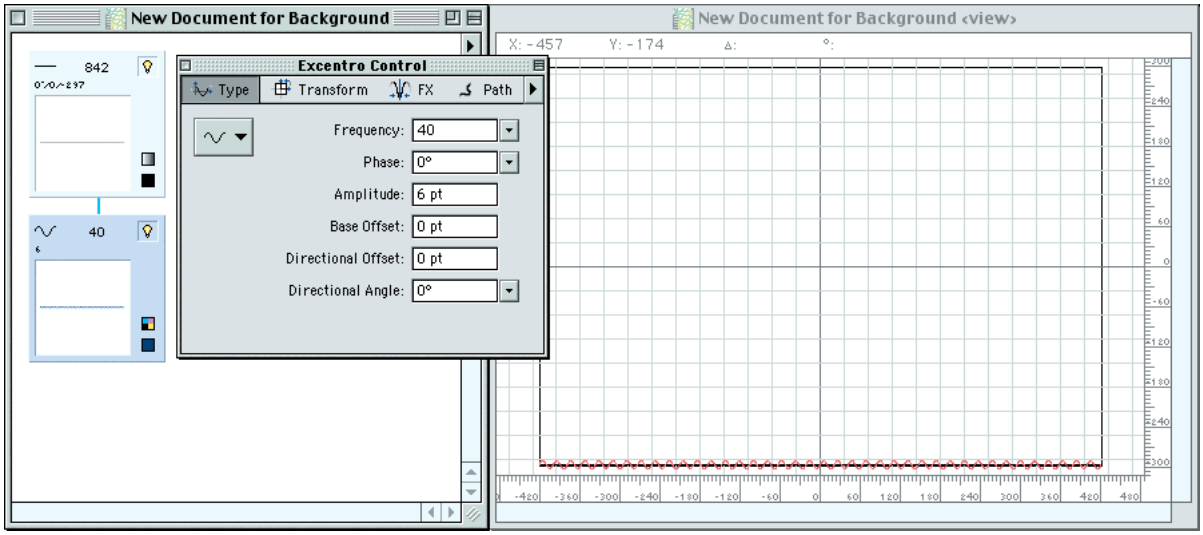
First Element: Select base object we created in step above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

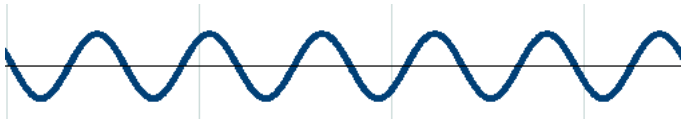
- **Frequency** = '*40*' (we need a lot of waves to cover whole width of A4 document)
- **Phase** = '*0°*' (default initial value, no need to change it)
- **Amplitude** = '*6 pt*' (this is the background, so waves should not be very high)
- **Base Offset** = '*0 pt*' (default initial value)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The first wavy path is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):



To finish with the first regular element creation let us apply stroke and color attributes to the path: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points (we want background paths to become visible, but not too thick, so other graphics and text placed above this background will remain readable). Mix appropriate color in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control** (for example, let it be some blue color).

You can zoom to area occupied by new path in preview document window to check its shape and color at higher magnification value:



Second Element: Let us create the second element by duplicating already existing one and modifying attributes of the copy. Select the regular element we created above and choose **Duplicate** command from **Structure** menu to create a copy of regular element. After that in **Excentro Control** inspector choose:

- '*Cycloid*' from **Type** pop-up menu

Change following attribute values:

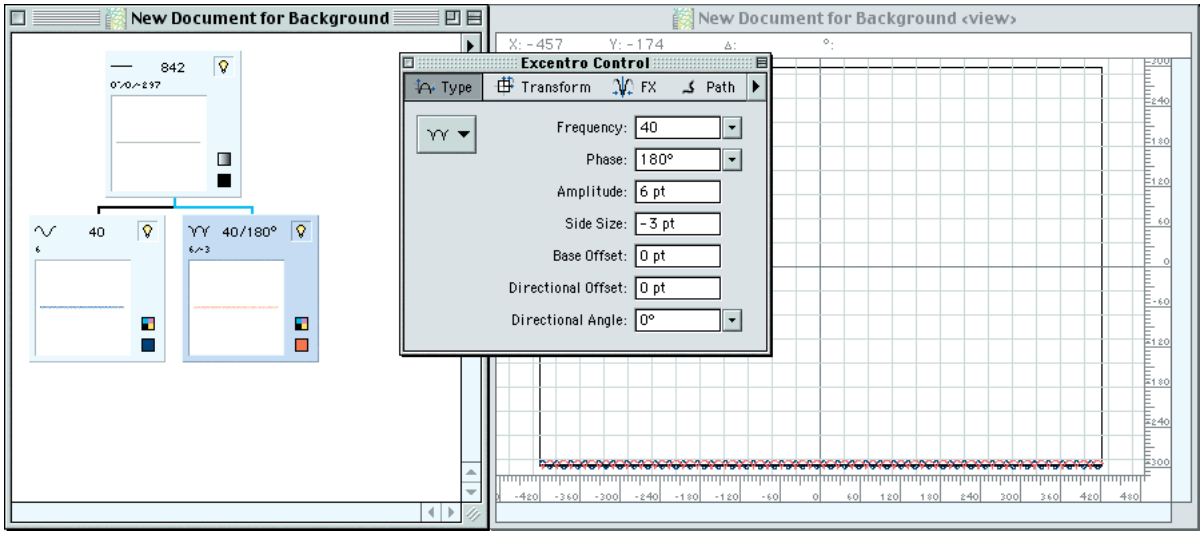
- **Phase** = '*180°*' (so waves of this element will be opposite to the first one)
- **Side Size** = '*–3 pt*' (this is the element of **Cycloid** type, to make it look different from **Sine Wave** we should enter some non-zero value in this field)

Other attributes should remain without change as that of the first element:

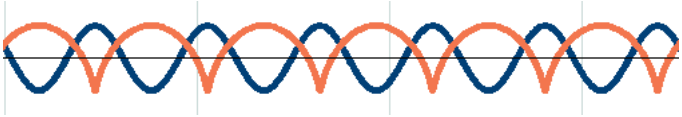
- **Frequency** = '*40*'
- **Amplitude** = '*6 pt*
- **Base Offset** = '*0 pt*'
- **Directional Offset** = '*0 pt*'
- **Directional Angle** = '*0°*'

Switch to **Path** panel of **Excentro Control** inspector and drop some different color from **Color Mixer** to **Color Well** of **Excentro Control** (for example, reddish color).

Both elements are ready. You should get following picture on your screen (preview of second path is shown with red because it is the selected object):



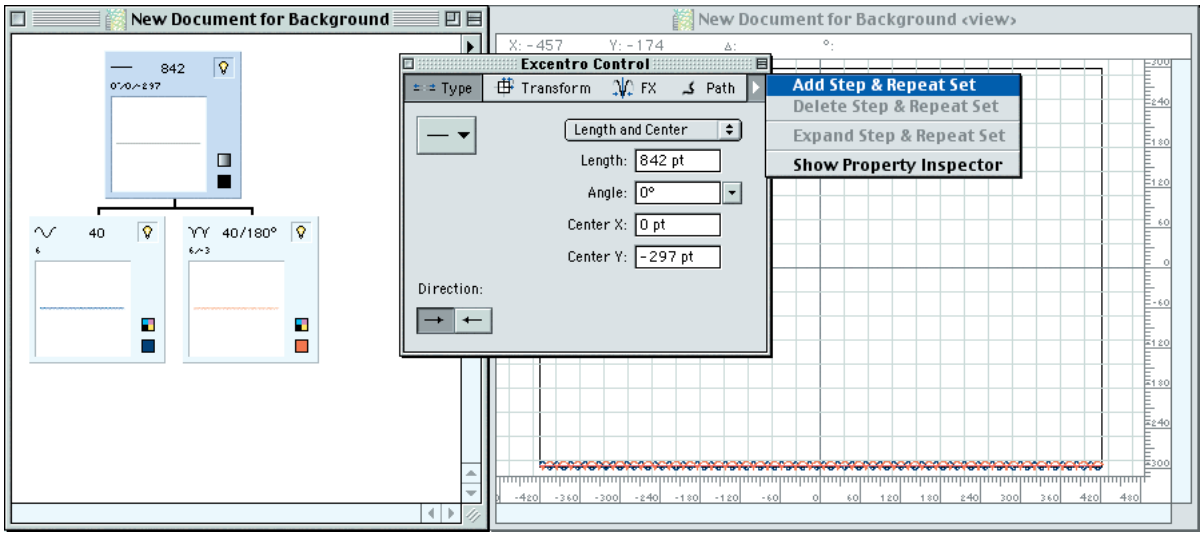
You can zoom to area occupied by these paths in preview document window to check their shape and color at higher magnification value:



■ **Step 4: Step & Repeat Set.** Now that we have two wavy paths ready all that is left to do to complete our linear background is to duplicate them as many times as needed to fill height of our A4 size document. We will use Step & Repeat Set feature of *Excentro* to accomplish this task instead of using **Duplicate** command to create copies of the objects and modifying their attributes. Step & Repeat Set feature was designed specifically for this purpose to avoid tiresome routine of manual duplication.

We will apply Step & Repeat Set modification to **Line** base object, because it is easier than to apply two identical Step & Repeat Sets to both regular elements. It also makes it more convenient to edit and modify at later time: changing attributes of single Step & Repeat Sets set is faster than doing it with two sets.

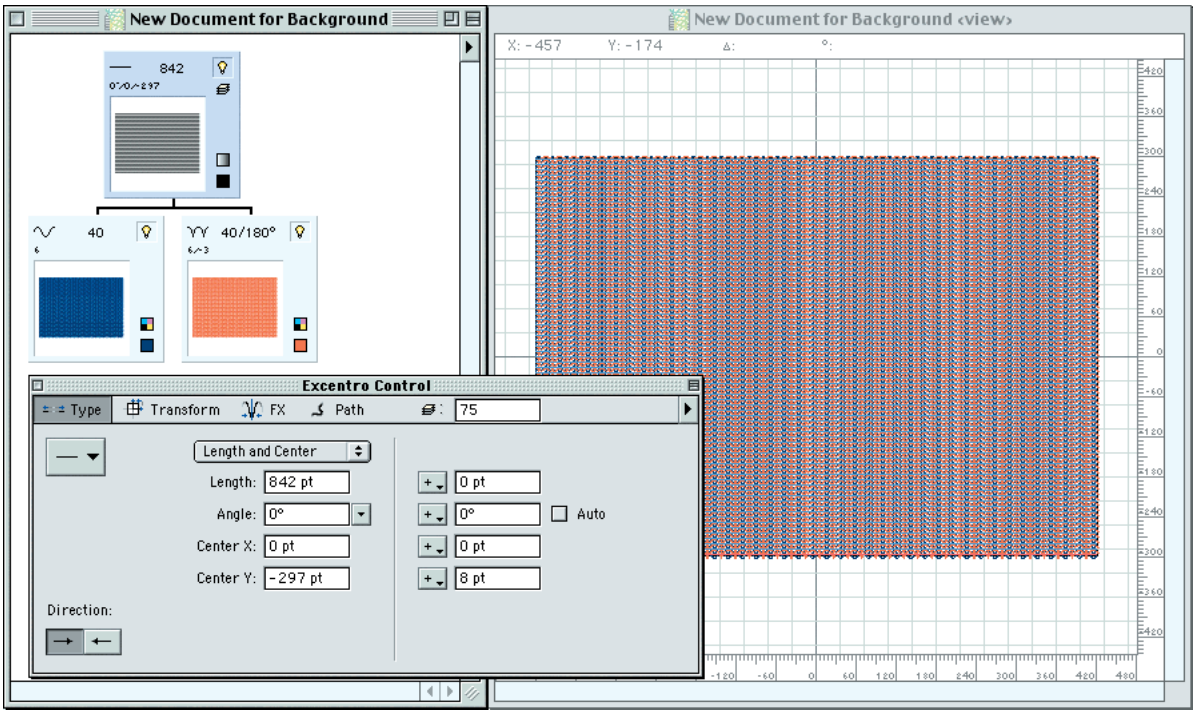
Select **Line** base object with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu (button with triangle in top right corner of the window).



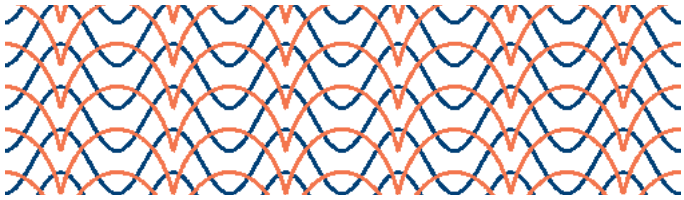
New Step & Repeat Set will be added to the object. Enter following values in Step & Repeat Set fields:

- **Number of Steps** = '*75*' (this will make a set of 75 paths: original path and 74 copies; it will be enough to cover whole height of A4 size document)
- **Center Y** = '*8 pt*' with **Constant** type of **Increment** (each copy of the paths will be positioned 8 points higher than previous one)

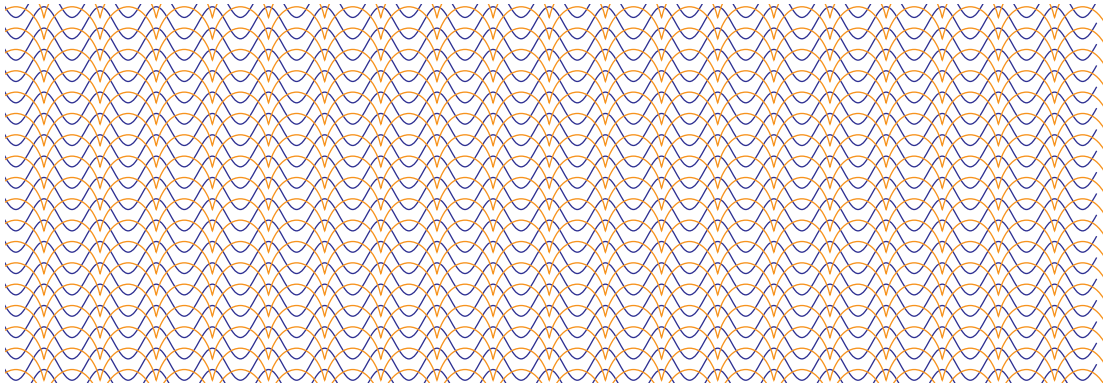
Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



After that switch to **Path** panel of **Excentro Control** inspector and switch off **Visible** check box of **Line** base object to make its paths invisible. Final background picture should look exactly like one shown on the first page of this chapter:



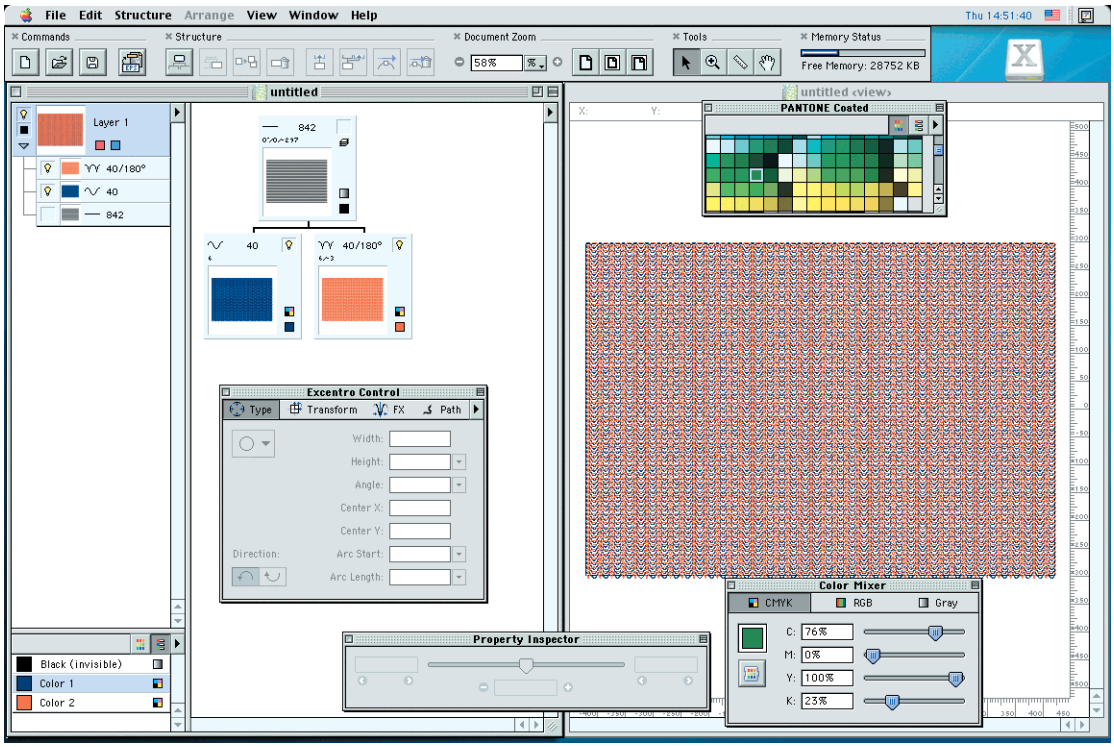
Now you can export this background in *Adobe Illustrator* format using **Export** command from **File** menu and use it as part of certificate, diploma, etc. Below is a part of the background in vector form:



TEMPLATE AND EXAMPLES

Stationary file '**Background Template 1.exc**' from '**Excentro Templates**' folder contains a copy of the document we created in previous section. You can use this template to create new backgrounds by modifying attributes of its objects without a need to reconstruct them in new file as was described above.

■ **Template Usage.** Launch *Excentro* application and open '**Background Template 1.exc**' file. New **untitled** document that contains copy of stationary file content will be opened in front of you:



Save this new document to whatever location on your hard disk you use for guilloche designs giving it meaningful name. Now you can modify objects attributes and create your custom background from the template:

◆ You can change color attributes of the objects. The easiest way to do so is to redefine '*Color 1*' and '*Color 2*' entries in document colors list. Just drag color patch from **Color Mixer** or swatch palette window to color patch (small colored rectangle) of '*Color 1*' or '*Color 2*'. This will automatically change color attributes of objects that use this colors list entry.

◆ You can modify objects attributes. For example: change of object's **Type** will modify its shape making it 'saw-like' or 'tooth-like' instead of wavy; change of object's **Frequency** will add or reduce number of waves or coils its shape has; change of **Side Size** of the **Cycloid** will make its coils smaller or larger, etc.

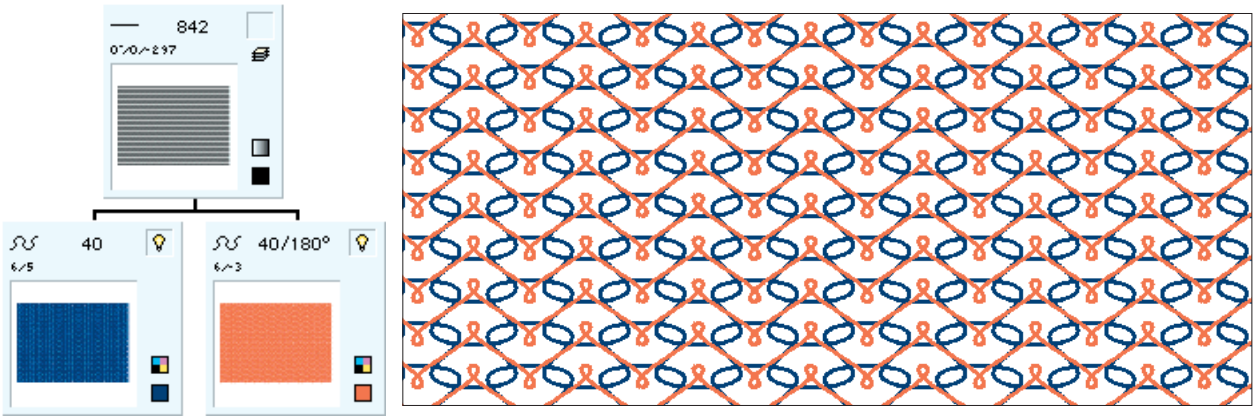
◆ You can add new regular elements objects to **Line** base object. This will increase number of paths the background consists of making pattern more complex and interesting.

◆ You can modify attributes of Step & Repeat Set changing distance between paths of the background. This will increase or decrease pattern paths 'density'.

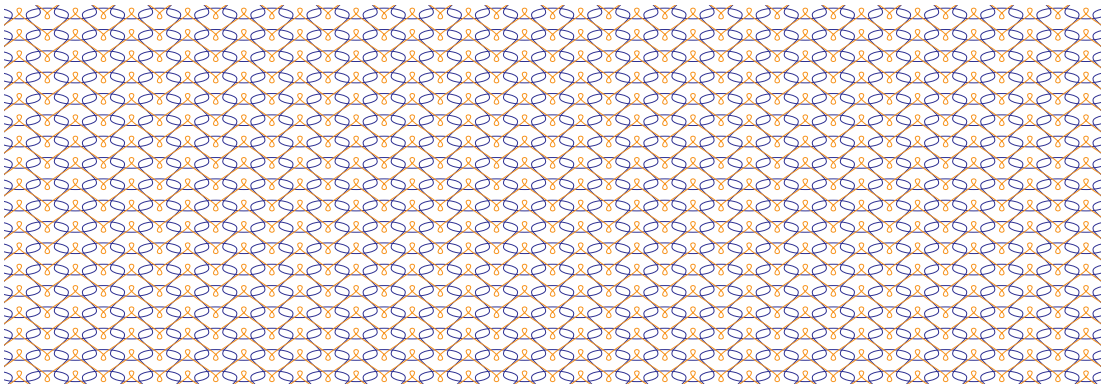
Examples of this template usage are located in '**Background Template 1 examples**' folder. They show most typical variations you can create using '**Background Template 1.exc**' template.

■ **Template Examples.** Let us take a quick look at examples of '**Background Template 1.exc**' variations from '**Background Template 1 examples**' folder.

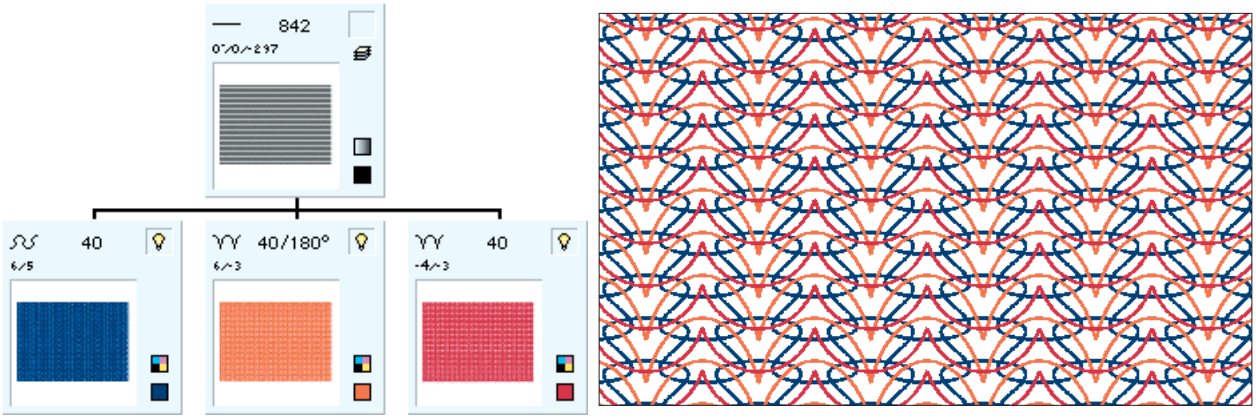
◆ **Example 1:** '**example 1.exc**' file contains background created from '**Background Template 1.exc**' template by changing **Type** attribute of both regular elements to '*Eight*'. First object also has **Side Size** attribute modified from initial default value of '*0 pt*' to '*5 pt*' to give it more interesting look comparing to that of original **Sine Wave** object.



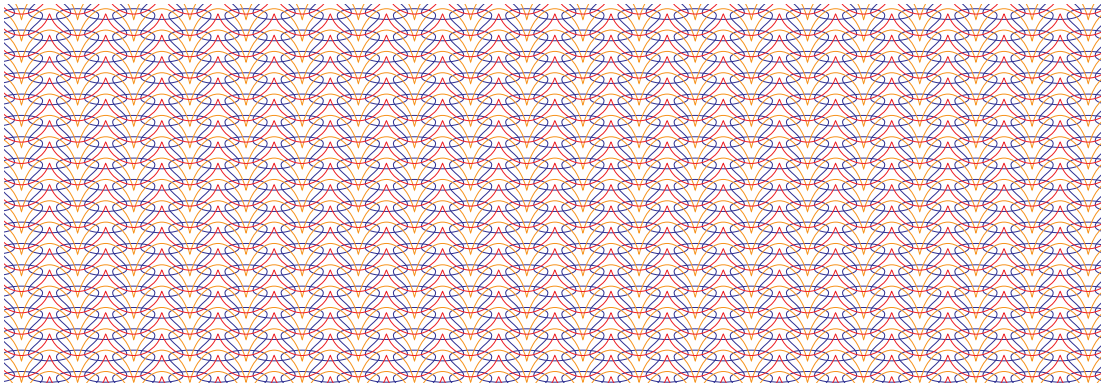
Picture below shows part of finished background in vector form:



◆ **Example 2:** '**example 2.exc**' file contains background created from '**Background Template 1.exc**' template by changing **Type** attribute of the first regular elements to '*Eight*', changing its **Side Size** attribute to '*5 pt*'. It also has one more regular element added to first two of the template: **Cycloid** with **Amplitude** = '*–4*' and **Side Size** = '*–3*'. This object is colored with bright red.

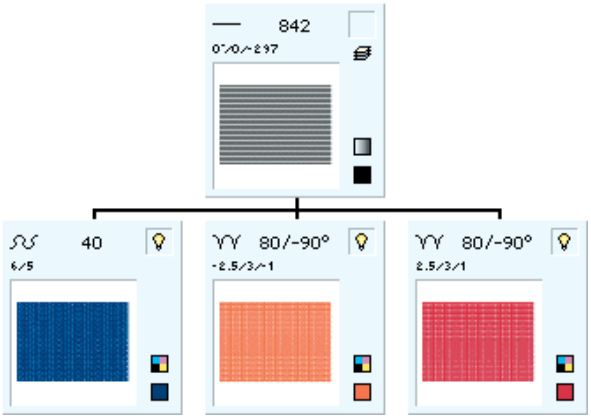


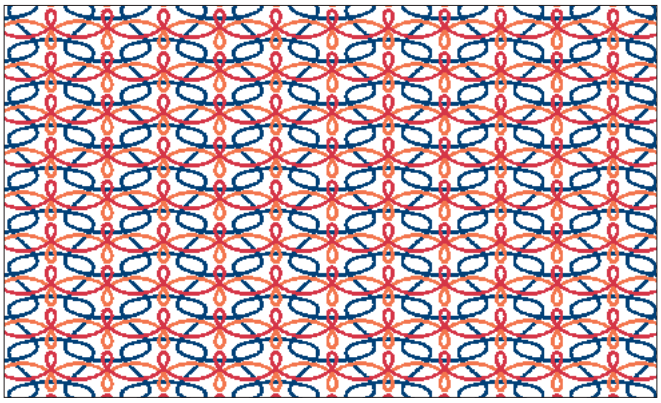
Picture below shows part of finished background in vector form:



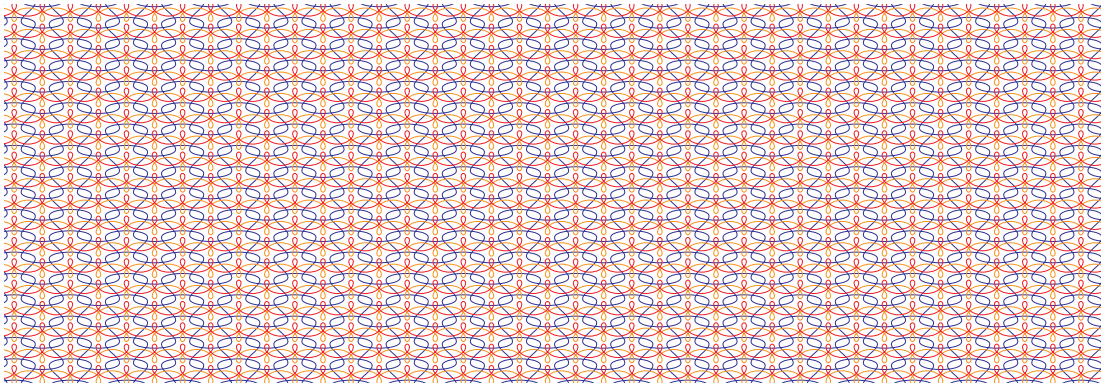
◆ **Example 3:** '**example 3.exc**' file contains another background created from '**Background Template 1.exc**' template. This example is similar to '**example 2.exc**'. It also has **Type** of the first regular elements changed to '*Eight*' and third **Cycloid** regular element with red path added to **Line** base object.

But in this case **Frequency** of both **Cycloid** elements is twice as high as **Frequency** of the first element, and their **Amplitude** attributes are lower than in the previous example. Both **Cycloid** elements have **Base Offset** attribute changed from default '*0 pt*' value. **Base Offset** of the first element set to '*–1 pt*' while the second element has value '*1 pt*'. In fact, if you will look at these elements paths you may note that their shapes are similar but appear to be reflected around horizontal line path of base object. Paths of **Cycloid** elements are constructed so that their coils form intersecting horizontal and vertical 8-like figures. This background is also has higher paths density comparing to previous ones.



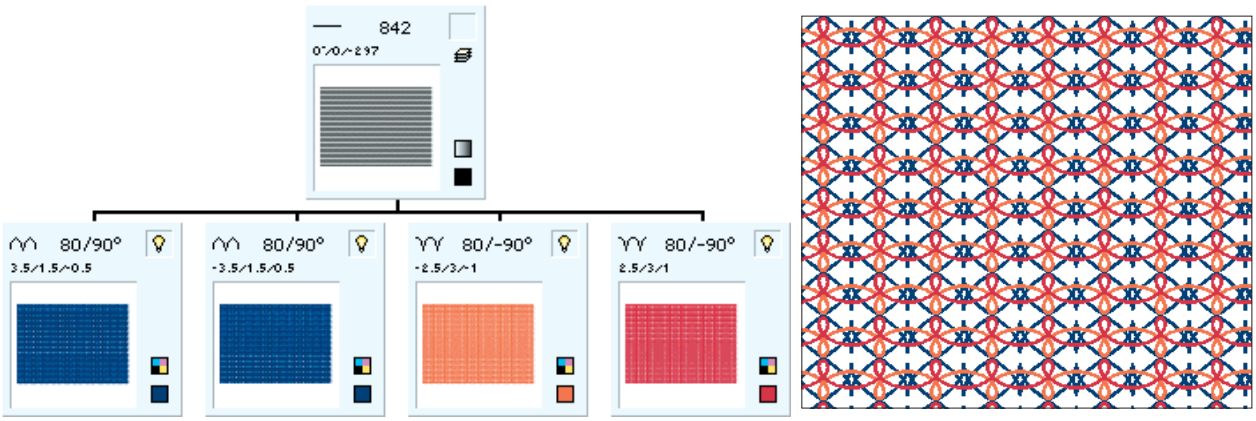


Picture below shows part of finished background in vector form:

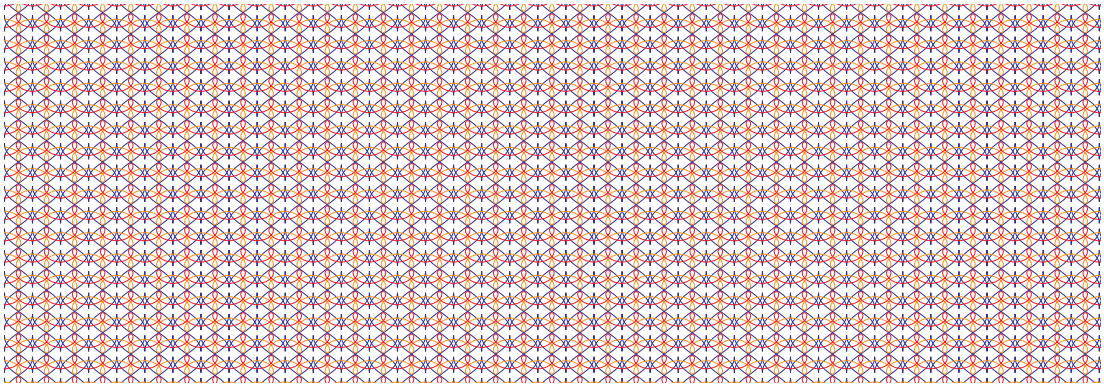


◆ **Example 4:** '**example 4.exc**' file is similar to '**example 3.exc**' it also has two **Cycloid** elements that form intersecting horizontal and vertical 8-like figures. These elements are identical to ones from previous example.

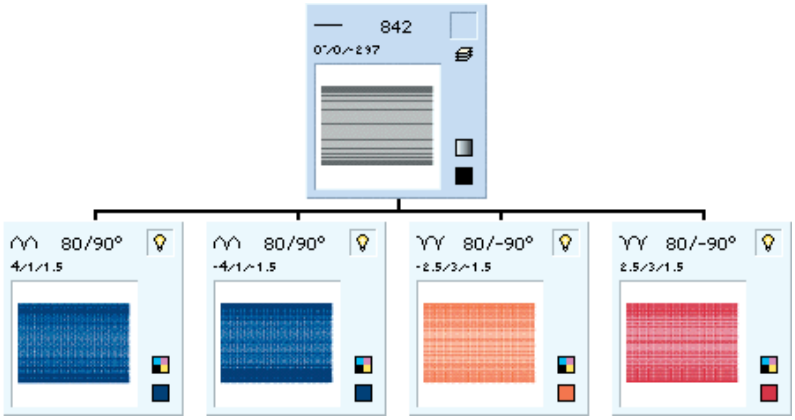
The first element of earlier examples in this case is replaced by a pair of **Spade** regular elements with doubled **Frequency**. Shapes of these elements are similar but appear to be reflected around horizontal line of base object, similar to paths of **Cycloid** elements. Paths of **Spade** elements form another intersecting pattern consisting of 'curly rhomboids' of two different sizes. Larger rhomboid encloses vertical 8 produced by **Cycloid** elements.



Picture below shows part of finished background in vector form:

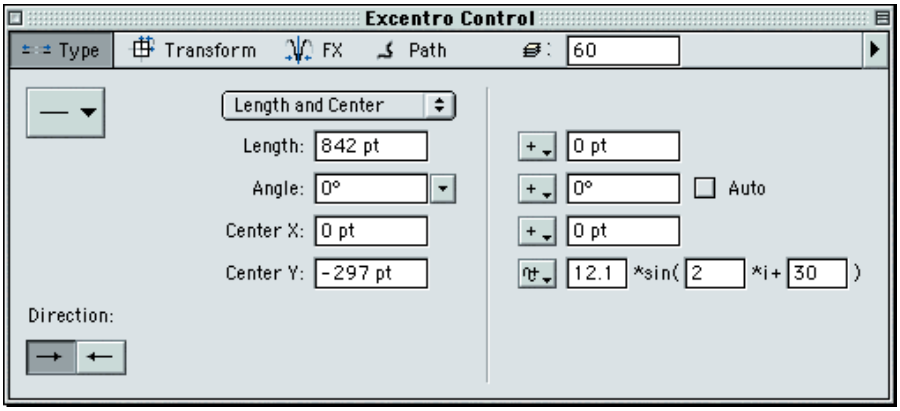


◆ **Example 5:** Objects of '**example 5.exc**' file are almost identical to that of previous '**example 4.exc**' (**Spade** and **Cycloid** elements have slightly different attributes, so that 8-figures and rhomboids they form have other sizes and intersection areas):



The main idea behind this example was not to show same objects with different attributes, but to illustrate case of Step & Repeat Set with different **Increment** type that will make vertical offset distance between copies of original paths in our background variable.

In previous cases Step & Repeat Set had **Increment** of **Constant** type with value '*8 pt*', so each next copy of the paths was positioned 8 points above the previous one. '**example 5.exc**' file shows Step & Repeat Set with **Increment** of **Sine+** type that offset each copy of the paths at variable distance.



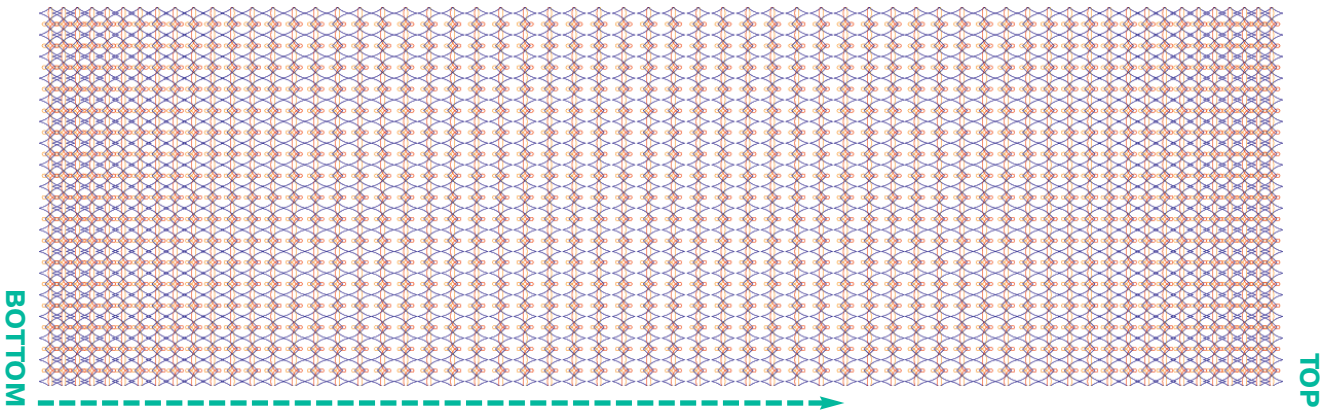
Sine+ type of **Increment** employs following formula to calculate the final increment value at each step (see **Chapter 5: Excentro Control** of **Excentro Windows Reference** for more details on different types of Step & Repeat Set increments):

$$increment = value1 \bullet sin(value2 \bullet number\_of\_step + value3)$$

Where *number_of_step* is the number of each step in the Step & Repeat Set, with value '*0*' (zero) corresponding to original unmodified path of the object.

Value3 in our case is '*30°*', *value2* is '*2*' and **Number of Steps** is '*60*'. This means that argument of *sin()* function steps through [30°; 150°] interval with step value of '*2°*'. *Value1* was chosen so, that paths of Step & Repeat Set fill whole height of A4 size document. Maximum increment value is '*12.1 pt*' in the middle of the document (*sin(90°) = 1*), minimum value is '*6.05 pt*' in bottom and top parts of the document (*sin(30°) = 0.5, sin(150°) = 0.5*). Increment values in between have variable values from '*6.05 pt*' to '*12.1 pt*' calculated using *sin()* formula above.

Following picture shows part of finished background (to save space on the page this illustration was rotated 90°, so paths became vertical instead of horizontal and offset distance varies from left to right instead of bottom to top, and scaled to fit picture area):



MAKING IT MORE COMPLICATED

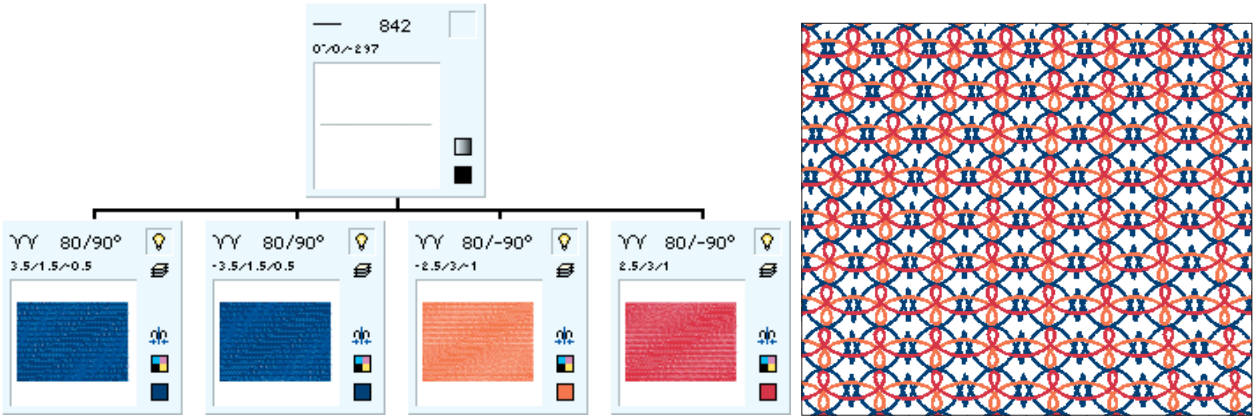
Examples above demonstrate usage of '**Background Template 1.exc**' stationary file to create simple linear backgrounds that use only three *Excentro* objects. These examples are quite suitable for diploma or certificate but not that good as security or anti-counterfeit measure. Simplicity of these backgrounds are their weakness: because each copy of original paths is identical except for new vertical offset distance. It is not very difficult to imitate this background. Counterfeiter only have to recreate two original paths and duplicate them required number of times — not impossible to do even in traditional vector drawing graphics package.

To make imitation a harder task we will try to make shapes of every copy of original paths slightly different in shape. After that our linear background will not be that simple and could not be imitated by vertical duplication of original paths. We will illustrate two techniques that could be used to achieve this effect:

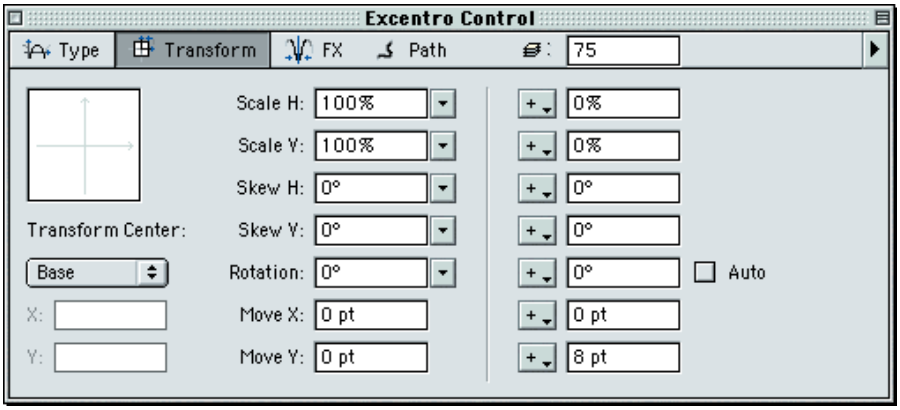
■ **Technique 1. Applying Step & Repeat Sets to Each Regular Element:** '**example 6.exc**' file contains almost same group of objects as '**example 4.exc**' with two major differences:

◆ **Type** of first two objects (the blue colored ones) is changed from '*Spade*' to '*Cycloid*' to get access to attributes from **FX** panel of **Excentro Control** (these are disabled for regular elements of **Spade** type)

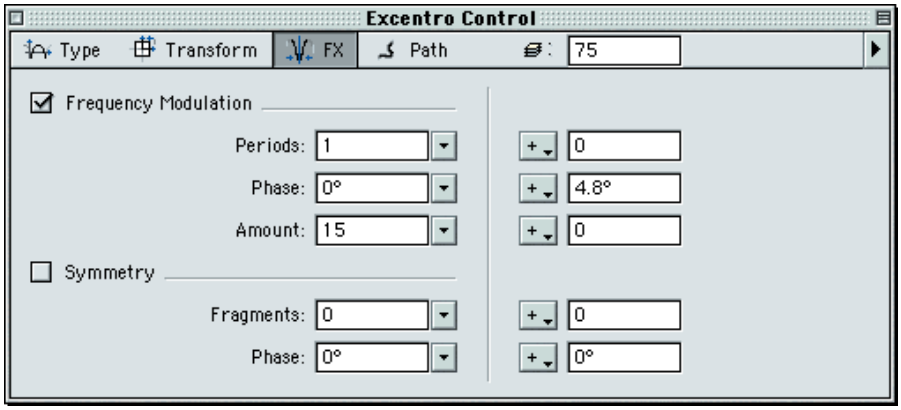
◆ Step & Repeat Set modifications are applied to each of regular elements independently (instead of single Step & Repeat Set applied to **Line** base object in all previous examples)



Applying Step & Repeat Set to regular elements allows us to modify attributes of each copy of paths our background consists of. To make paths of the background fill height of A4 size document (just like before) we should set same value of '*75*' in **Number of Steps** field and same value of '*8 pt*' in **Move Y** field of **Transform** panel (to offset each copy of paths vertically by same 8 points value):



Our aim is to make paths of every copy of original paths slightly different in shape. To achieve this effect we apply Step & Repeat Set modification to almost every attribute of the regular elements. In this example we will limit ourselves to **Frequency Modulation** group of attributes from **FX** panel of **Excentro Control**. Let us enter following values for these attributes of all regular elements:



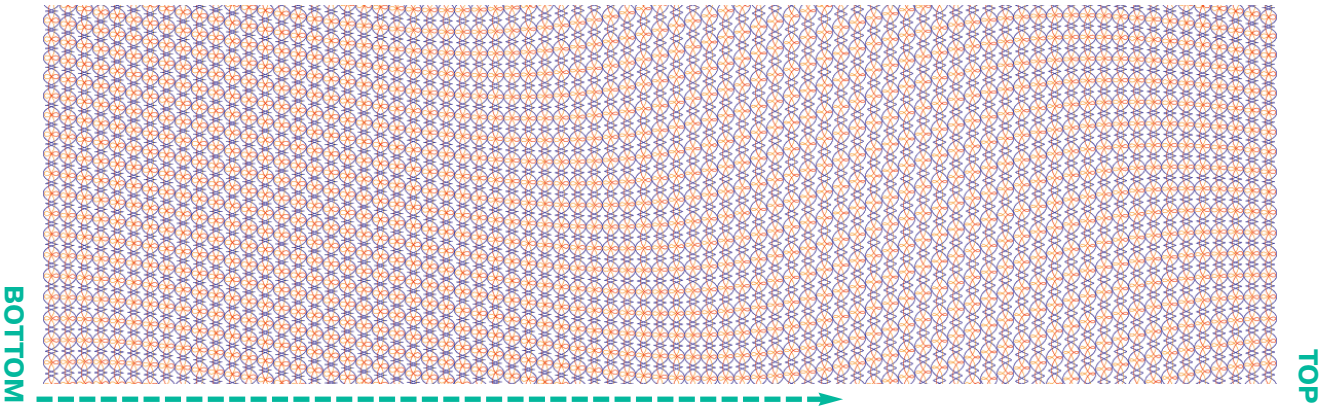
In non-Step & Repeat Set fields in **FX** panel of **Excentro Control**:

- **Frequency Modulation** checkbox — '*On*' (switch **on** this checkbox to activate **Frequency Modulation** effect and other fields of this group)
- **Periods** ='*1*' (this will create single area of higher/lower **Frequency** in every copy of the path)
- **Phase** ='*0°*' (default initial value: the first area of higher **Frequency** starts at the beginning of the path)
- **Amount** ='*15*' (in area of higher **Frequency**, **Frequency** attribute reaches value '*95*': *80 + 15 = 95*, in area of lower **Frequency**, **Frequency** attribute reaches value '*65*': *80 – 15 = 65*)

In Step & Repeat Set fields:

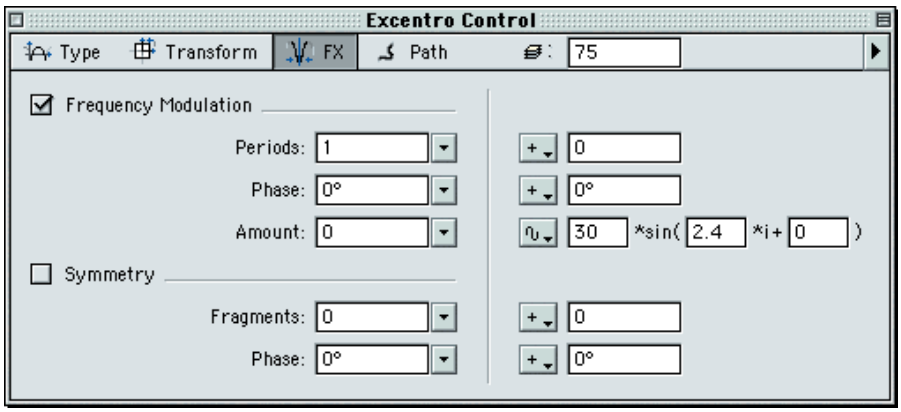
- **Phase** = '*4.8°*' with **Constant** type of **Increment** (each copy of the paths will have additional 4.8° shift of **Phase** attribute in **Frequency Modulation** group; this value was calculated as *4.8° = 360°/75* so copies of paths that belong to Step & Repeat Set will cover whole [0°; 360°] interval)

Following picture shows part of finished background (just like with '**example 5.exc**' picture it is rotated 90° and scaled to save space and fit in picture area):



As you can see, now every copy of the paths has variable **Frequency** attribute with different **Phase** shift of modulation. In addition to anti-counterfeit feature this background also acquired nice looking wavy pattern in vertical direction (it is horizontal on the picture above because the picture is rotated).

'**example 7.exc**' file contains another variation on modifications of **Frequency Modulation** attributes group in Step & Repeat Set. This time **Phase** attribute stays unmodified while **Amount** attribute changes using **Sine** type **Increment**:



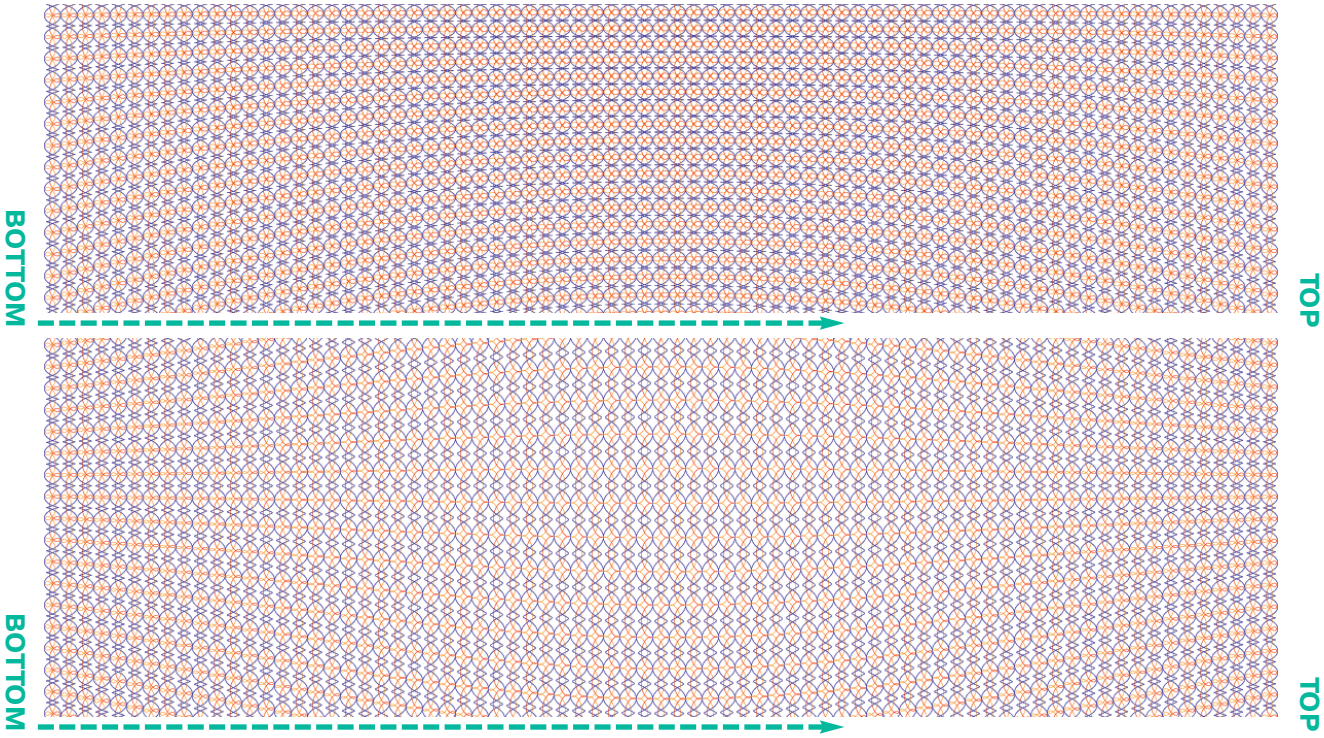
Sine type of **Increment** is calculated using following formula:

$$increment = value1 \bullet sin(value2 \bullet number\_of\_step + value3)$$

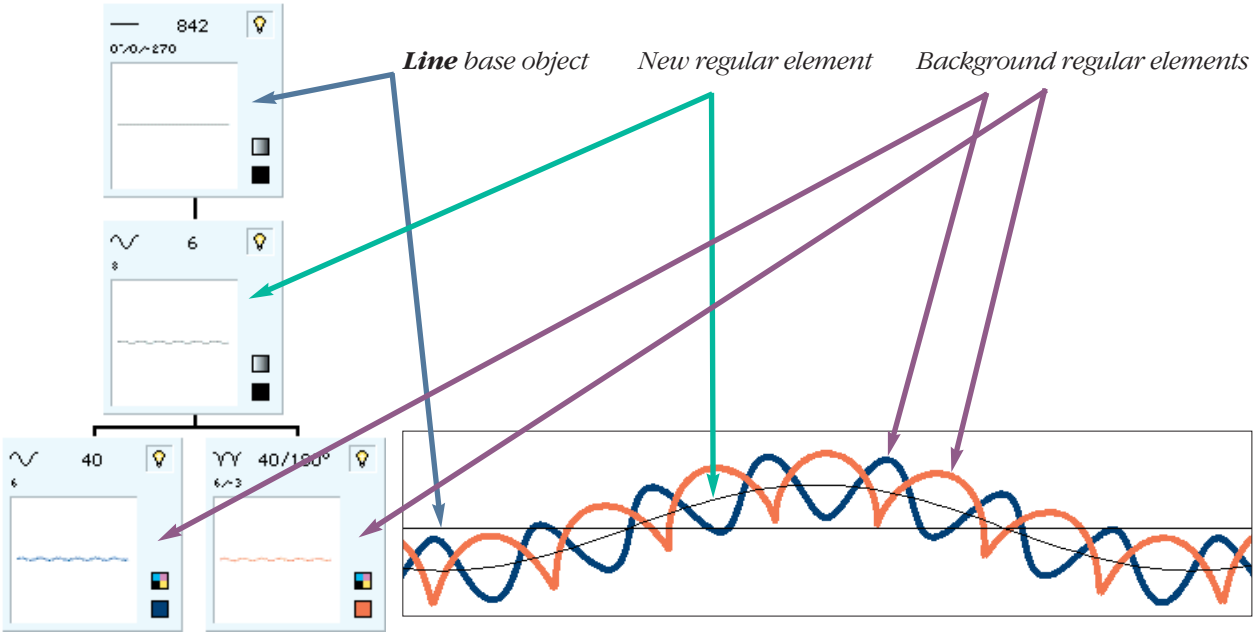
Number_of_step is the number of each step in the Step & Repeat Set, with value '*0*' (zero) corresponding to original unmodified path of the object. *Value1* is '*30*'. *Value2* is '*2.4°*' it is calculated as *2.4° = 180°/75,* so copies of paths cover [0°; 180°] interval with increment value changing from '*0*' (*30 • sin(0°) = 0*) in bottom area of the background to '*30*' (*30 • sin(90°) = 30*) in the middle and back to '*0*' (*30 • sin(180°) = 0*) in top area again.

As a result the first path in bottom area and the last path in top area have unmodified **Frequency** of '*80*', while paths in the middle have maximum **Frequency Modulation** attributes values with area of higher **Frequency** of '*110*' (*80 + 30 = 110*) and area of lower **Frequency**, of '*50*' (*80 – 30 = 50*).

Following pictures show left and central parts of finished background (just like with previous pictures they are rotated 90° and scaled to fit picture area). Left and right parts of the background have higher **Frequency** of the paths in middle areas. Central part of the background has lower **Frequency** of the paths. This leads to 'bubble-like' effect:

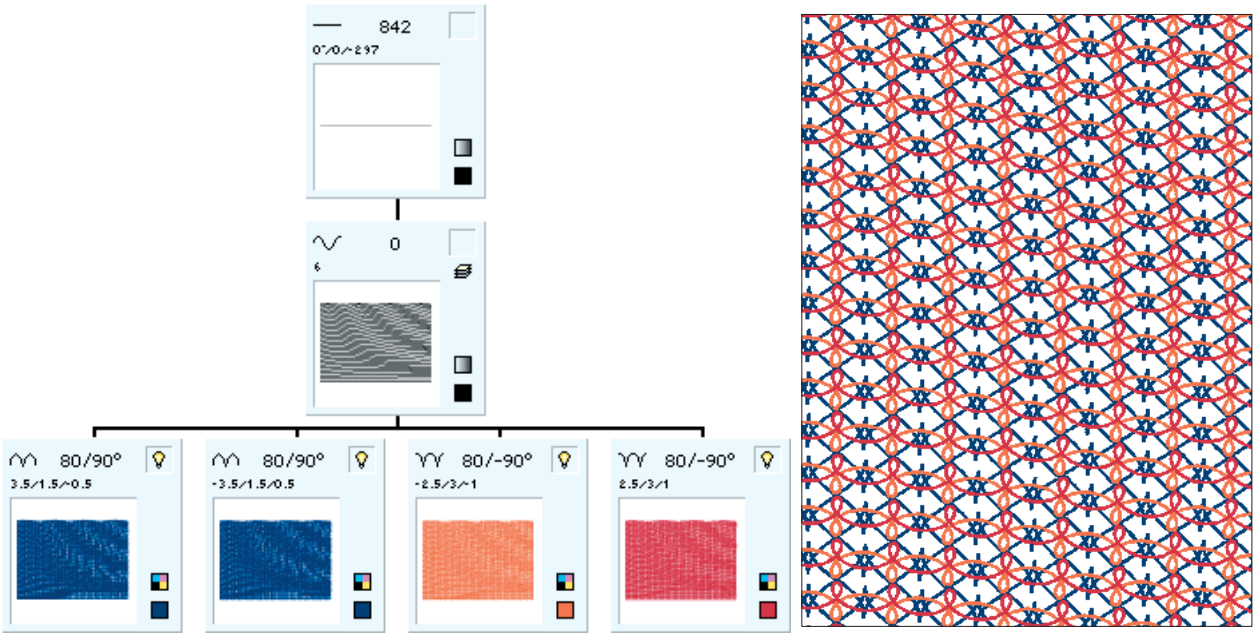


■ **Technique 2. Using Regular Element as Base for Background Paths:** Another solution that allows to create copies of original paths with different shape is to use another regular element as parent object for background paths instead of **Line** base object (this new regular element will be based on **Line** base object in its turn). Guilloche structure of design built on this technique shown on following picture (compare with illustration on the first page of this chapter):



If we will apply Step & Repeat Set modification to this new regular element instead of **Line** base object, and this Step & Repeat Set will change type attributes that control shape of the path as well as its vertical offset, we will receive background that does not contain paths of identical shape. Paths of this new regular element should be made invisible at the end of background construction process, just like the path of **Line** base object.

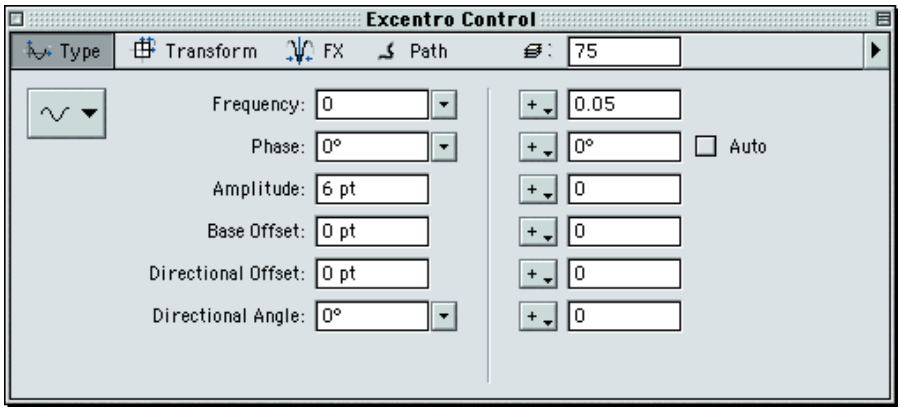
'**example 8.exc**' file from '**Background Template 1 examples**' folder represents modification of objects of '**example 4.exc**' according to this technique:



New regular element of **Sine Wave** type is added to the design. All paths of the background have their parent object changed to this new element (could be done by simple drag-and-drop actions with rectangular representations of objects in main document window).

Frequency attribute of the new object is set to '*0 pt*' (this way original path of this object in Step & Repeat Set will be just plain horizontal line, same as that of **Line** base object). **Amplitude** attribute of the object is set to '*6 pt*' (so waves of Step & Repeat Set would not be too 'high' and 'steep').

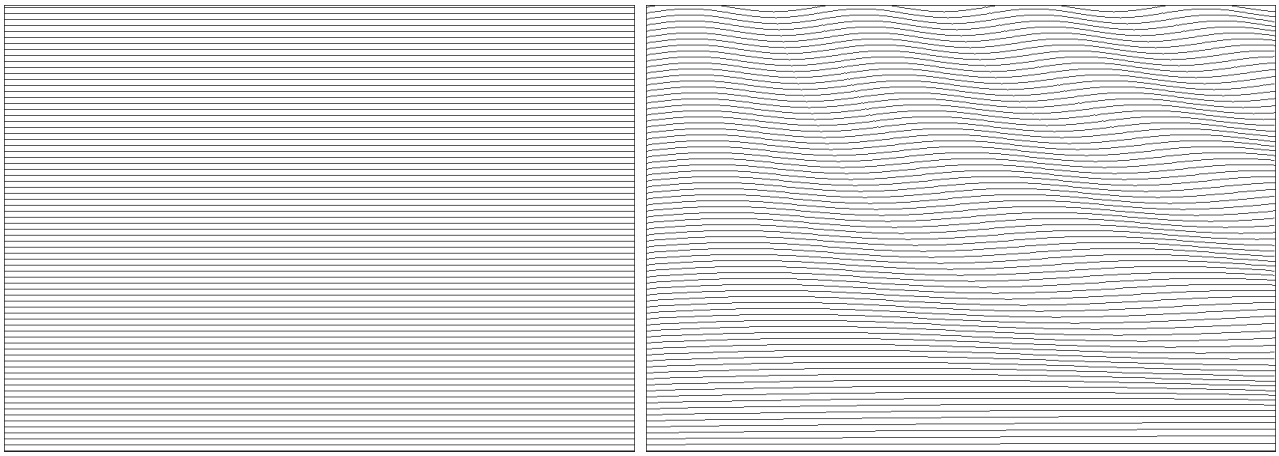
Step & Repeat Set modifications are applied to this object with following attributes:



◆ **Number of Steps** field is set to '*75*'. **Move Y** field value of **Transform** panel is set to '*8 pt*'. These are the same values as in previous examples, required to fill height of A4 size document.

◆ **Frequency** field of **Type** panel has value '*0.05*' with **Constant** type of **Increment** (each copy of the paths will have 0.05 higher value of **Frequency** attribute; so the first path of Step & Repeat Set will have initial '*0*' value **Frequency** of **Sine Wave**, 20th path will have **Frequency** of '*1*' (*20 • 0.05 = 1*), 40th path will have **Frequency** of '*2*' (*40 • 0.05 = 2*), the last 75th path will have **Frequency** of '*3.75*' (*75 • 0.05 = 3.75*).

Next two pictures compare paths produced by Step & Repeat Set applied to **Line** base object (left) of '**example 4.exc**' and paths produced by Step & Repeat Set applied to new regular element of **Sine Wave** type in present example (right). Paths of four regular elements our background consists of use these paths as bases at every step of the Step & Repeat Set. So shapes of paths of four regular elements will all remain the same in **Line** base object case (left) and will change together with **Frequency** attribute modification in **Sine Wave** element case (right). This is exactly what we wanted to achieve: background paths in this example will all be of different shape.



Following picture shows the central part of the finished background (just like with the previous pictures it was rotated 90° and scaled to fit picture area):

Central part of the background

'**example 9.exc**' file is another illustration of same technique. Step & Repeat Set in this example does not modify **Frequency** attribute of **Sine Wave** element directly: its value in **Type** panel of **Excentro Control** remains at zero. This time we apply modification to **Frequency Modulation** attributes of **FX** panel.

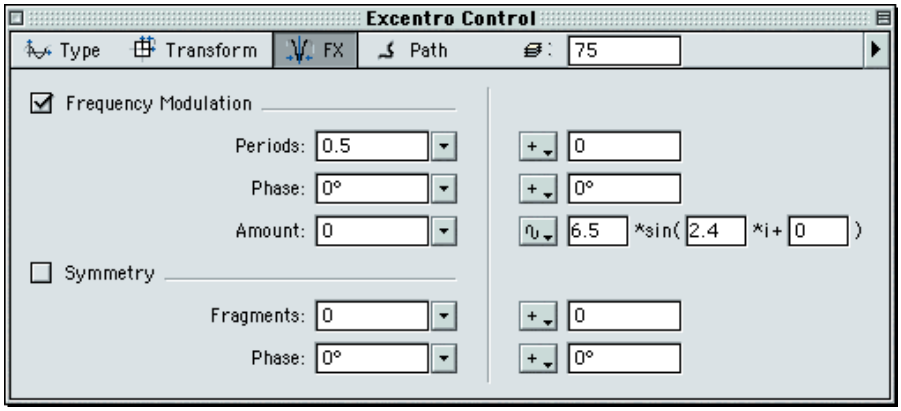
In non-Step & Repeat Set fields in **FX** panel of **Excentro Control**:

- **Frequency Modulation** checkbox — '*On*' (switch **on** this checkbox to activate **Frequency Modulation** effect and other fields of this group)
- **Periods** ='*0.5*' (this will create single area of higher **Frequency**)
- **Phase** ='*0*" (default initial value: first area of higher **Frequency** starts at the beginning of the path)
- **Amount** ='*0*' (default initial value)

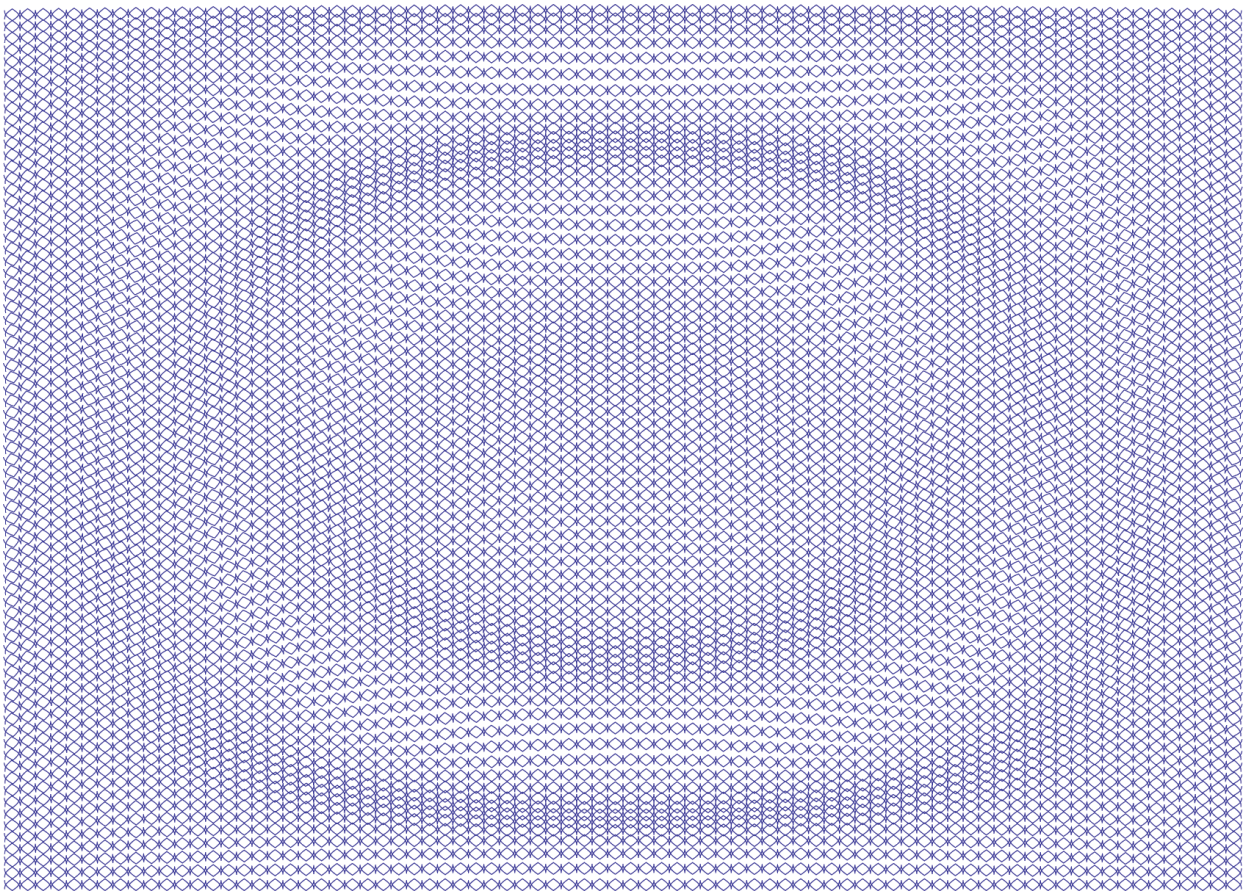
In Step & Repeat Set fields:

- **Amount** = '*6.5 • sin(2.4° • number_of_step + 0°)*', where *number_of_step* is the number of each step in the Step & Repeat Set. Value of '*2.4*" it is calculated as *2.4° = 180°/75,* so copies of paths cover [0°; 180°] interval with increment value changing from '*0*' (*6.5 • sin(0°) = 0*) in bottom area of the background to '*6.5*' (*6.5 • sin(90°) = 6.5*) in the middle and back to '*0*' (*6.5 • sin(180°) = 0*) in top area again.

As a result the first path in bottom area and the last path in top area have unmodified **Frequency** of '*0*', while paths in the middle have maximum **Frequency Modulation** attributes values with area of higher **Frequency** of '*6.5*' and area of lower **Frequency**, of '*–6.5*' (negative number may look like a very strange case of **Sine Wave** element **Frequency** attribute, nevertheless it is allowed in *Excentro* as a value of **Amount** attribute of **Frequency Modulation** group).



Following picture shows image of the finished background. You may notice interesting effect that looks like droplet aftermath on water surface.



CHAPTER 3: BLENDED BACKGROUNDS

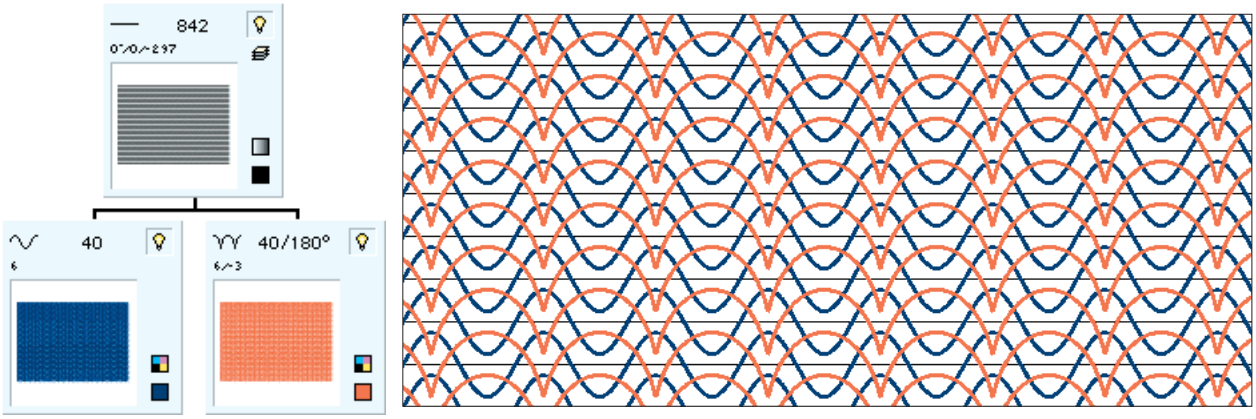
Classic linear background we constructed in previous chapter is well suited for all guilloche design goals. Unfortunately it has one but serious drawback: it is not exactly the best solution as anti-counterfeit measure. Paths that linear background consists of are identical in shape and differ only by their vertical offset value. So, to make an imitation of this background it is enough to recreate shapes of first original paths and duplicate them required number of times. This could be a time consuming task to perform with standard vector illustration package, but it is not impossible or even too difficult to accomplish.

To amend this situation and make imitation more difficult task we should try to create a background with all paths of different shape, that can not be reproduced by simple duplication of several original paths. There are ways to create such background with measures mentioned in the last section of previous chapter, but they are probably a bit too complicated for novice users of *Excentro*.

In this chapter we introduce alternative way to create linear backgrounds that allows creation of 'easy to make' but 'hard to counterfeit' designs. Example we will construct is the same as that of stationary file '**Background Template 2.exc**' from '**Excentro Templates**' folder. You can use this template to create new backgrounds by modifying attributes of its objects without a need to reconstruct them in new file following all steps described below.

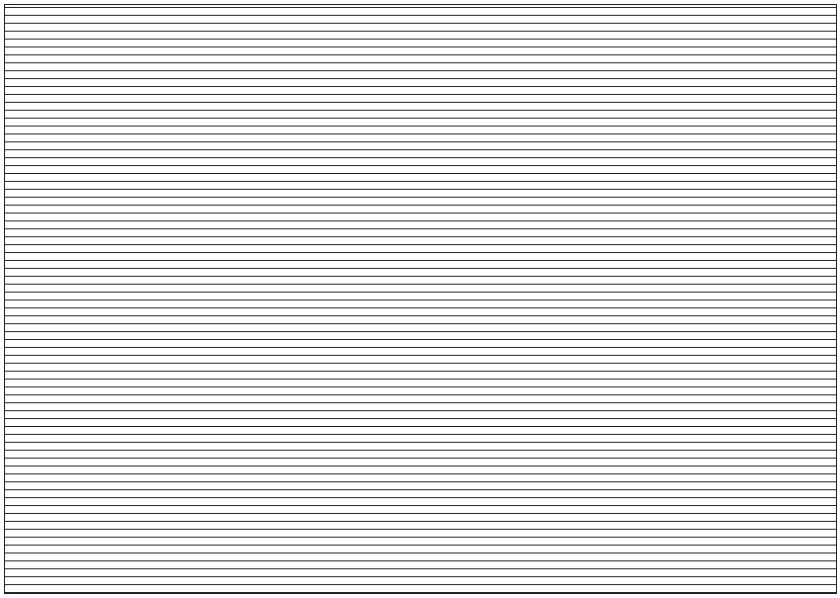
CASE STUDY

In previous chapter we defined 'classic linear background' as sets of interlacing wavy paths placed one above another. Sets of paths classic linear background consists of are identical in shape and differ only by their vertical offset distance. Typical guilloche tree of classic linear background is shown on following picture:



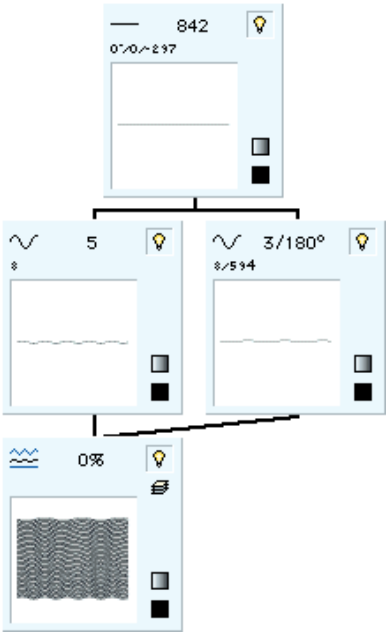
As you can see this background consists of identical groups of two original paths positioned one above another. Vertical duplication is achieved by Step & Repeat Set modification of base object of **Line** type. On every step of Step & Repeat Set two original paths are based on horizontal lines with different vertical offset value.

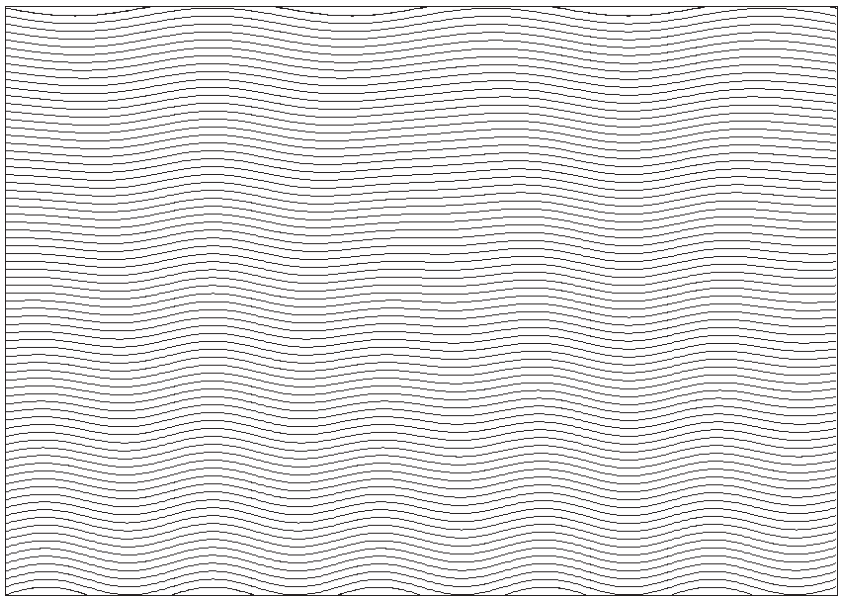
If we will switch off visibility of two regular elements we will get picture that shows only horizontal lines of **Line** base object produced by Step & Repeat Set (see illustration on following page). These lines are parallel and have same length, as a result paths produced by two regular elements with this Step & Repeat Set modification are of identical shape.



If we will use as base for regular elements of the background an object that has path of variable shape at every step of Step & Repeat Set, paths of these regular elements will also be of different shape at every step. In previous chapter we showed example that uses regular element of **Sine Wave** type with variable **Frequency** as a parent object for regular elements of the background. In this chapter we will use content element of **Blend** type for same purpose.

Content element of **Blend** type represents effect of merging paths of its parent elements one into another. Path of **Blend** content element resembles shape of path of one of its parent elements depending on how close it is positioned to this path. For our purpose: creation of advanced linear background with all paths of different shape, **Blend** content element is the ideal solution. It allows more path shape variations comparing to that of regular element of **Sine Wave** type with variable **Frequency**. Consider design with following guilloche tree structure:

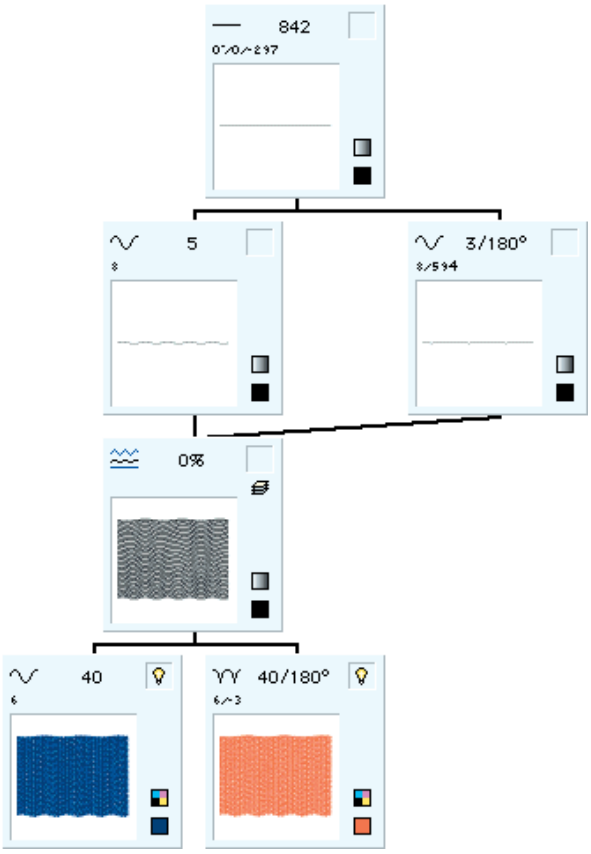


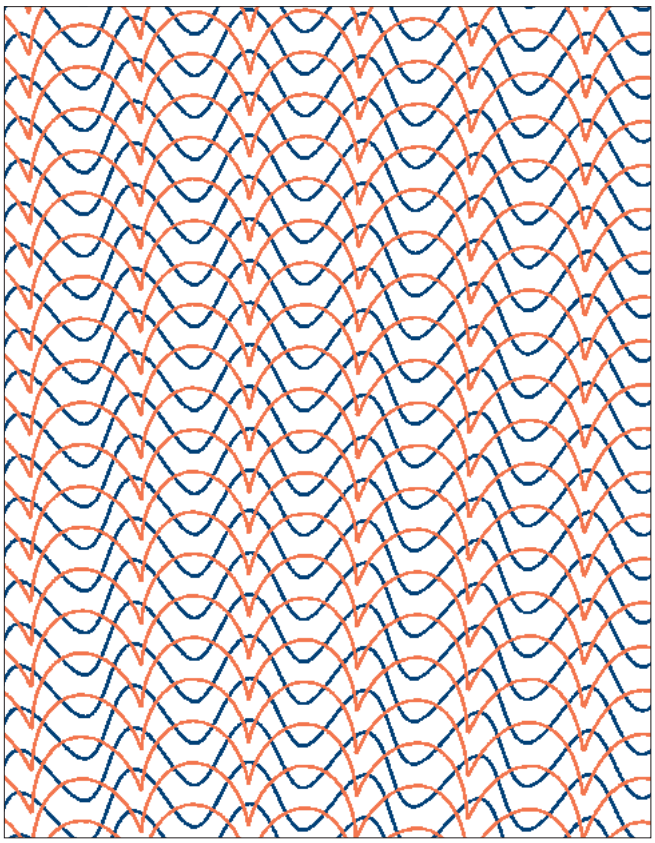


This example uses base object of **Line** type just like classic linear background. **Line** base object is used as parent for two regular elements of **Sine Wave** type. These regular elements have different attributes and therefore different shape of paths. Between these

paths we created additional content element of **Blend** type with Step & Repeat Set that modifies its **Ratio** attribute. Paths of this element have variable shape at every step of Step & Repeat Set because it changes from shape of the first regular element's path to shape of the second regular element's path according to value of its **Ratio** attribute.

All is left to do to complete the background is to add a couple of regular elements with interlacing paths that use **Blend** content element as their parent object. Paths of these regular elements will be repeated at every step of Step & Repeat Set together with path of **Blend** element. Shapes of these paths will be different at every step, because the path they use as base is variable. Paths of these regular elements compose the texture of our 'blended linear background', all other paths can be made invisible when design is complete. Guilloche structure of finished background is shown on following picture:



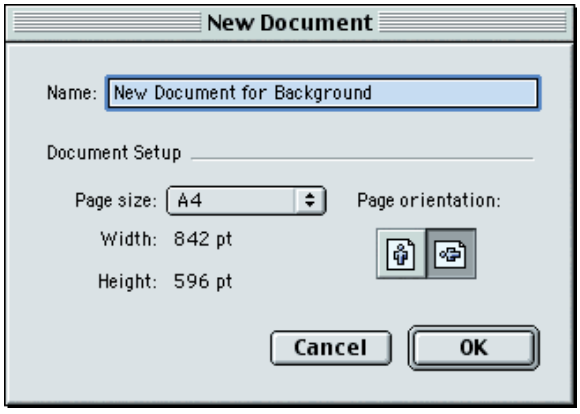


Last two regular elements of this background are the same as that in case of classic linear background on first page of this chapter. You can compare two pictures to see differences in their shape and in the pattern of the background. Although parts of these backgrounds look somewhat similar at large magnification, all paths of second background are different and can not be imitated by duplication of few original paths in standard vector illustration package. To imitate second background the person who will dare this task will have to redraw every single path this background consists of and it will be much more time consuming comparing to simple duplication.

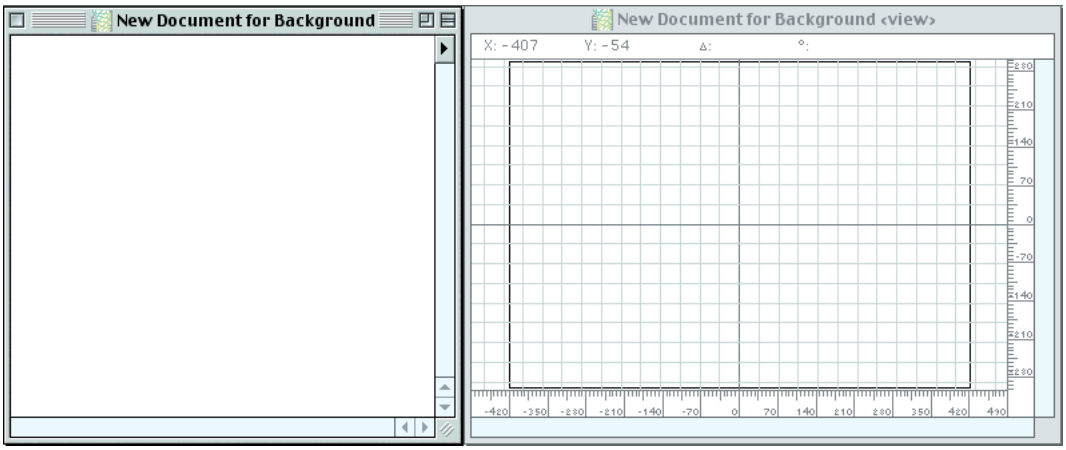
STEP BY STEP BACKGROUND CREATION

In this section we provide detailed description of all steps required to create 'blended linear background' that uses content element of **Blend** type with variable paths.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Select proper predefined document size from pop-up menu or enter custom size in **Width** and **Height** fields. To simplify work and graphics preview new document should have the same size as the background you want to create. In this example we will try to create background of '*A4*' size with '*Landscape*' orientation that could be used for standard diploma or certificate.



Click **OK** button and two windows of new document will appear in front of you.



■ **Step 2: Line Base Object.** Since we create 'linear' background we should create base object of **Line** type with **Length** equal to width of the document and with position in bottom part of the document.

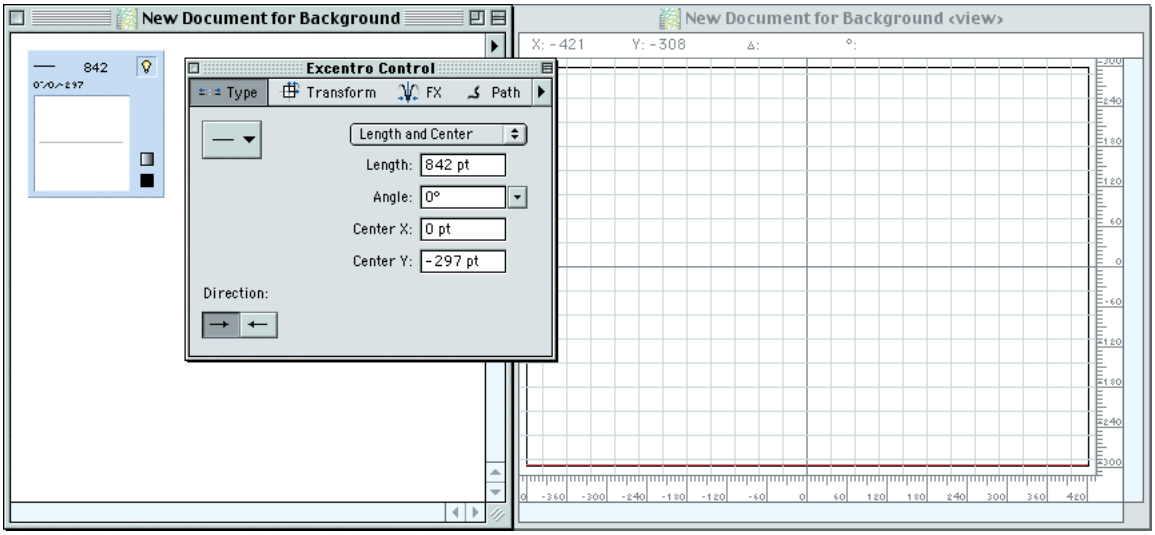
Choose **New Base** command from **Structure** menu to create new base object. After that in **Excentro Control** inspector choose following options:

- '*Line*' from **Type** pop-up menu
- '*Length and Center*' from Line options pop-up (it will be easier to control length of the line in case we will need to change document size later)

Enter following attributes in appropriate fields of **Excentro Control** inspector:

- **Length** = '*842 pt*' (full document width)
- **Angle** = '*0°*' (our line should be horizontal)
- **Center X** = '*0 pt*' (horizontal center of the document)
- **Center Y** = '*–297 pt*' (bottom position in the document)

Base creation is finished, you should get following picture on your screen (preview of line base is shown with red in document preview window because it is the selected object):



■ **Step 3: Top and Bottom Regular Elements.** Now we shall create two regular elements that will form top and bottom borders of our background.

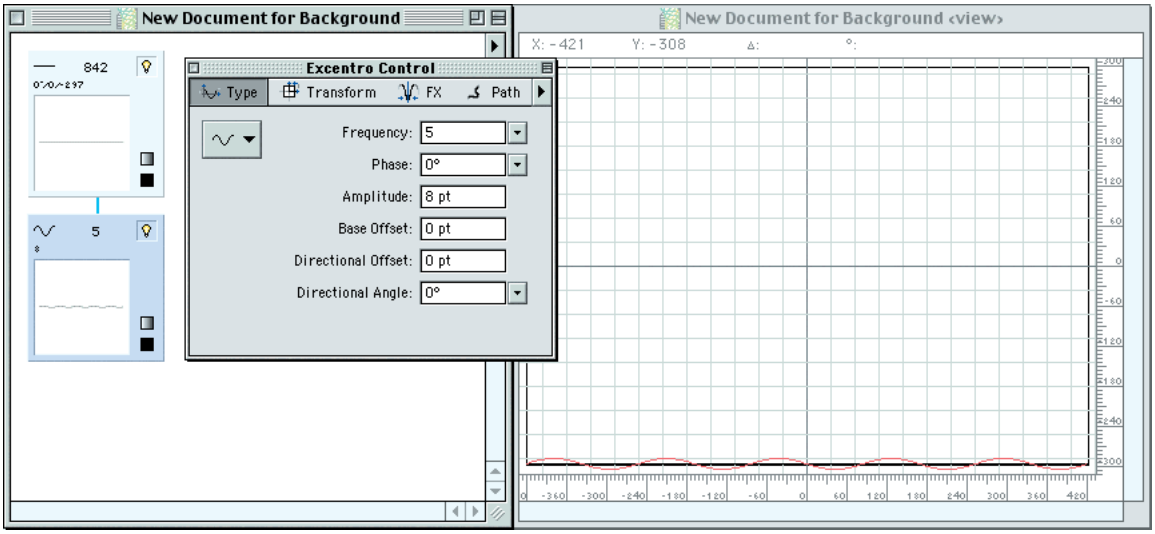
Bottom Element: Select base object we created in step above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Frequency** = '*5*' (we need these border elements to have only few waves)
- **Phase** = '*0°*' (default initial value, no need to change it)
- **Amplitude** = '*8 pt*' (this is a border element, so waves should not be very high)
- **Base Offset** = '*0 pt*' (default initial value that will keep path of the element in bottom part of the document together with path of its parent **Line** base object)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

Bottom regular element is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):



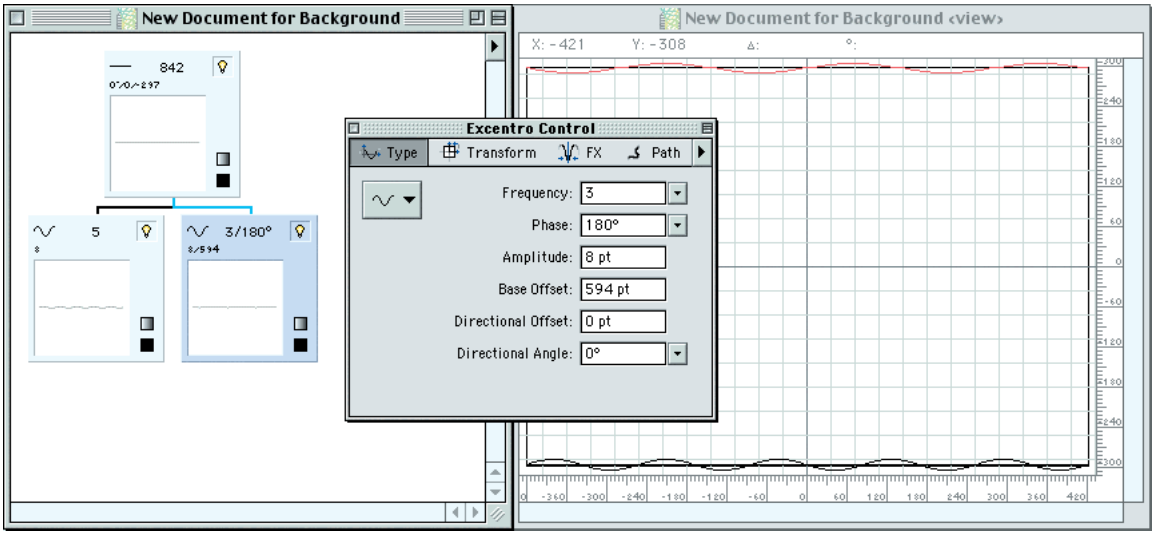
Top Element: Let us create the second border element by duplicating already existing bottom one and modifying attributes of the copy. Select regular element we created above and choose **Duplicate** command from **Structure** menu to create a copy of regular element. After that in **Excentro Control** inspector window change following attribute values:

- **Base Offset** = '*594 pt*' (path of this border element should be positioned in top part of the document)
- **Frequency**= '*3*' (this element should have different attributes comparing to the bottom one, **Frequency** is the most significant attribute of **Sine Wave**)
- **Phase** = '*180°*' (waves of this element will start and end in opposite positions to waves of the bottom element)

Other attributes should remain without changes:

- **Type** = '*Sine Wave*'
- **Amplitude** = '*8 pt*
- **Directional Offset** = '*0 pt*'
- **Directional Angle** = '*0°*'

Both border elements are ready. You should get following picture on your screen (preview of second element's path is shown with red because it is the selected object):



■ **Step 4: Blend Content Element.** Now we shall create content element of **Blend** type between two border paths.

Select bottom regular element with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer top regular element in main document window. Rectangular representation of the first clicked element should become blue (selected object color), rectangular representation of the second element should become reddish (second selected object color). Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

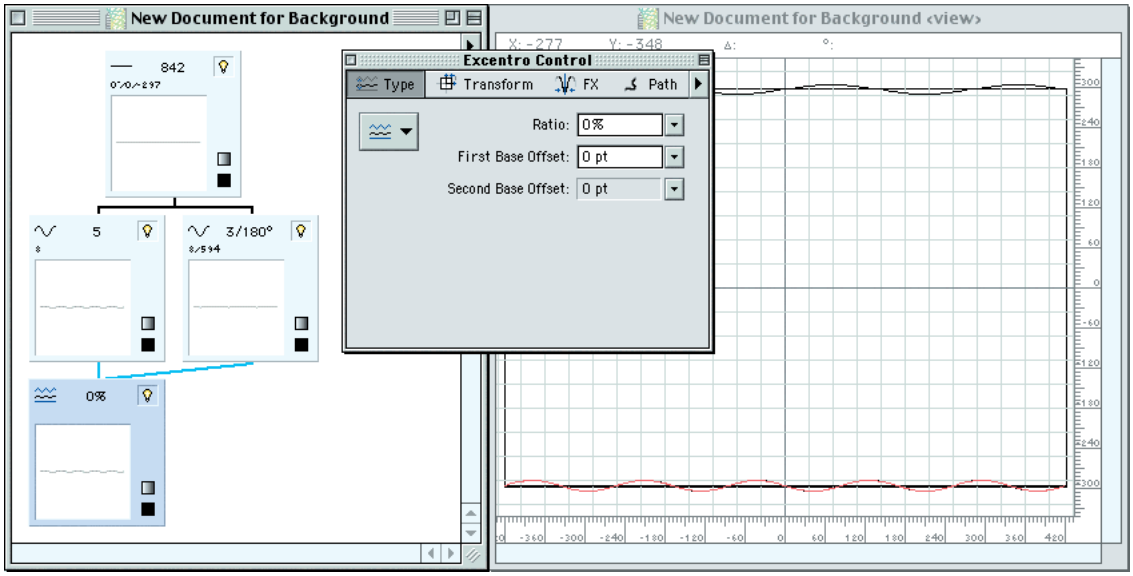
- '*Blend*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Ratio** = '*0%*' (we are going to apply Step & Repeat Set to this object later, to cover all [0%; 100%] interval, let us set initial value of first original path to 0%)
- **First Base Offset** = '*0 pt*' (default initial value, no need to change it)

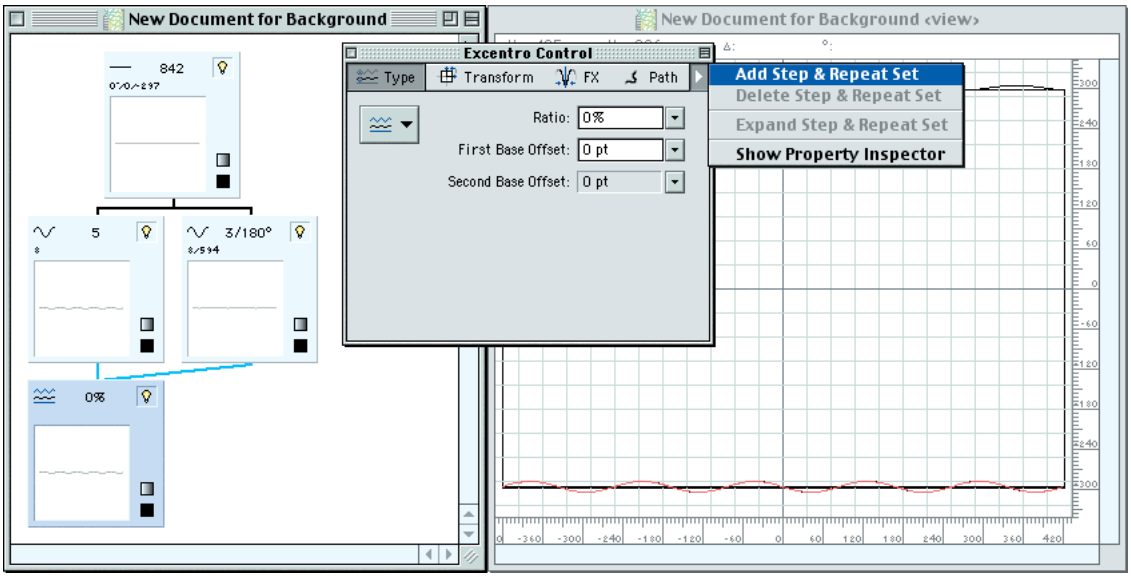
◆ **Second Base Offset** = '*0 pt*' (default initial value)

You should get following picture on your screen (preview of content element's path is shown with red because it is selected, it coincides with bottom element's path because **Ratio** attribute is set to '*0%*' and **First Base Offset** is set to '*0 pt*'):



■ **Step 5: Step & Repeat Set.** We will apply Step & Repeat Set modification to **Blend** content element, so that its paths will fill space between paths of two border regular elements.

Select **Blend** content element with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu (button with triangle in top right corner of the window).

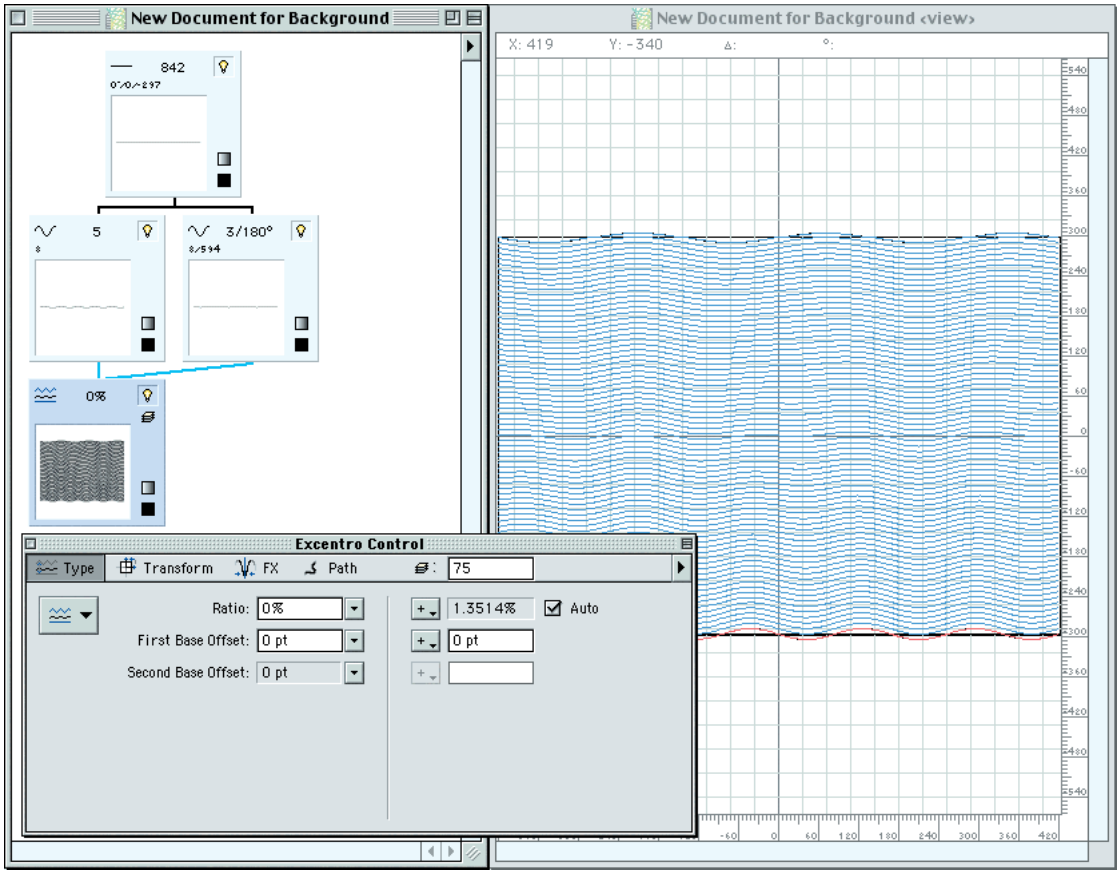


New Step & Repeat Set will be added to the object. Enter following values in Step & Repeat Set fields:

◆ **Number of Steps** = '*75*' (this will make a set of 75 paths: original path of **Blend** content element and 74 additional copies; it will be enough to cover whole height of A4 size document with suitable distance between paths)

◆ **Ratio** — click **Auto** checkbox beside numeric field and **Ratio** attribute value will be automatically calculated so, that 75 paths of **Blend** content element cover all [0%; 100%] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



■ **Step 6: Regular Elements of Background.** Now we shall create wavy paths that will form texture of our background.

First Element: Select **Blend** content element with Step & Repeat Set we created in steps above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

◆ '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

◆ **Frequency** = '*40*' (we need a lot of waves for this background path to cover whole width the document)

◆ **Phase** = '*0°*' (default initial value, no need to change it)

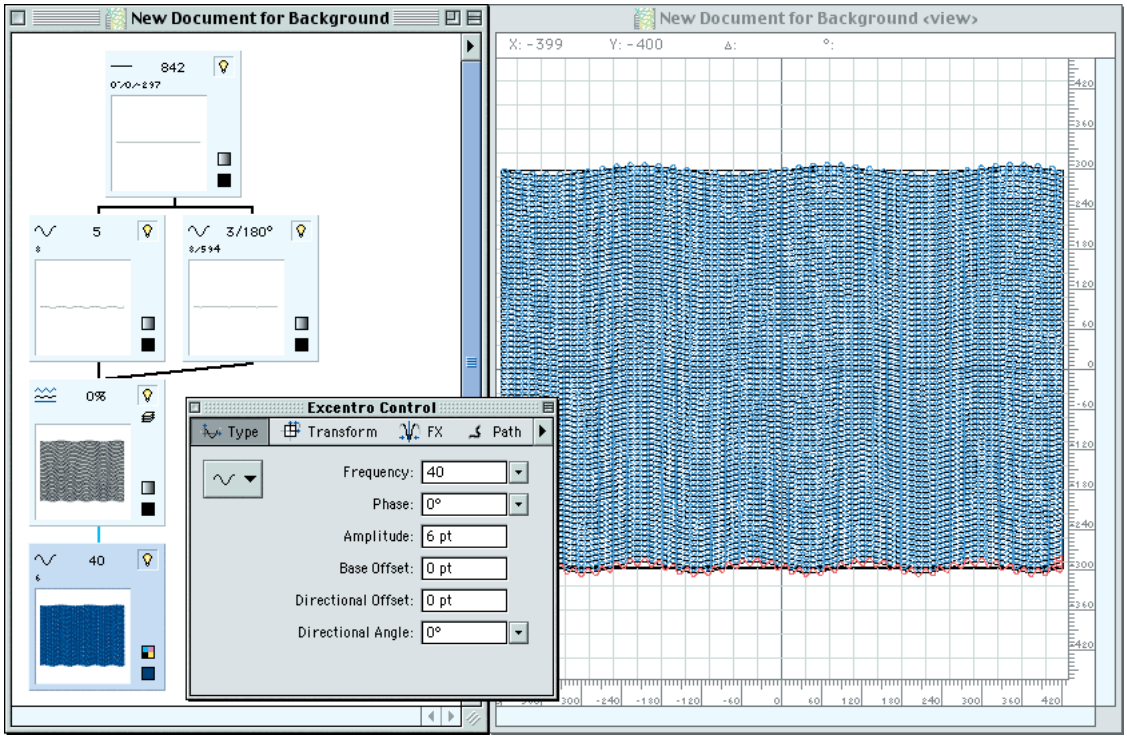
◆ **Amplitude** = '*6 pt*' (this is the background, so waves should not be very high)

◆ **Base Offset** = '*0 pt*' (default initial value)

◆ **Directional Offset** = '*0 pt*' (default initial value)

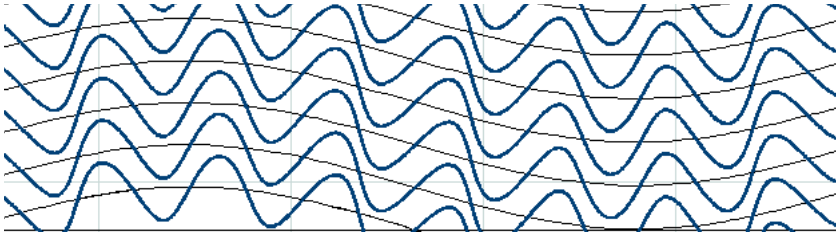
◆ **Directional Angle** = '*0°*' (default initial value)

First regular elements is ready, you should get following picture on your screen (the path is automatically duplicated with Step & Repeat Set of **Blend** content element; it is shown with selection colors of current layer because it is selected):



To finish with the first regular element creation let us apply stroke and color attributes to its path: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points (we want background paths to become visible, but not too thick, so other graphics and text placed above this background will remain readable). Mix appropriate color in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control** (for example, let it be some blue color).

You can zoom to area occupied by new paths in preview document window to check their shape and color at higher magnification value:



Second Element: Just like with the border elements, let us create the second background element by duplicating already existing one and modifying attributes of the copy. Select the first background regular element we created above and choose **Duplicate** command from **Structure** menu to create a copy of the regular element. After that in **Excentro Control** inspector choose:

- '*Cycloid*' from **Type** pop-up menu

Change following attribute values:

- **Phase** = '*180°*' (so waves of this element will be opposite to the first one)
- **Side Size** = '*–3 pt*' (this is the element of **Cycloid** type, to make it look different from **Sine Wave** we should enter some non-zero value in this field)

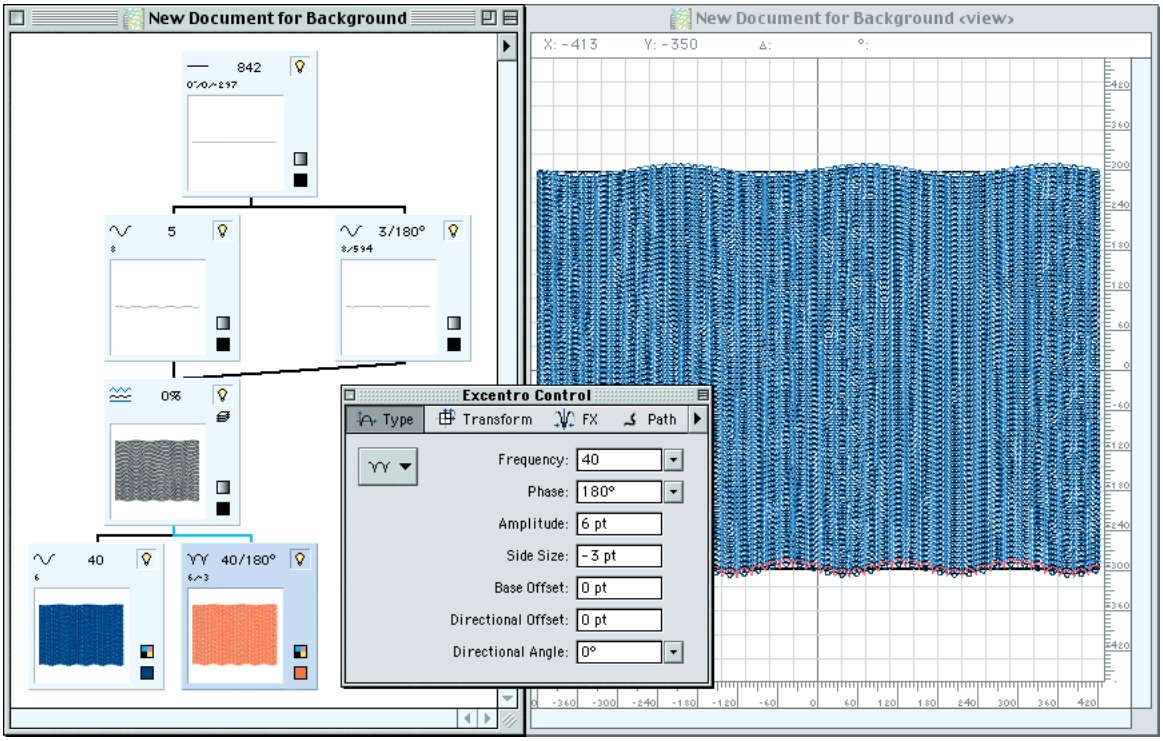
Other attributes should remain without change as that of the first element:

- **Frequency** = '*40*'

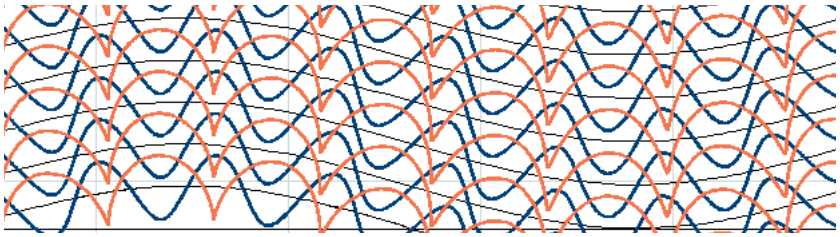
- **Amplitude** = *'6 pt*
- **Base Offset** = *'0 pt'*
- **Directional Offset** = *'0 pt'*
- **Directional Angle** = *'0°*

Switch to **Path** panel of **Excentro Control** inspector and drop some different color from **Color Mixer** to **Color Well** of **Excentro Control** (for example, reddish color).

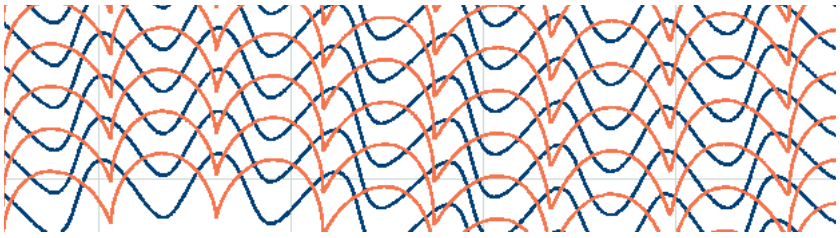
Both background elements are ready. You should get following picture on your screen (the path is automatically duplicated with Step & Repeat Set of **Blend** content element; it is shown with selection colors of current layer because it is selected):



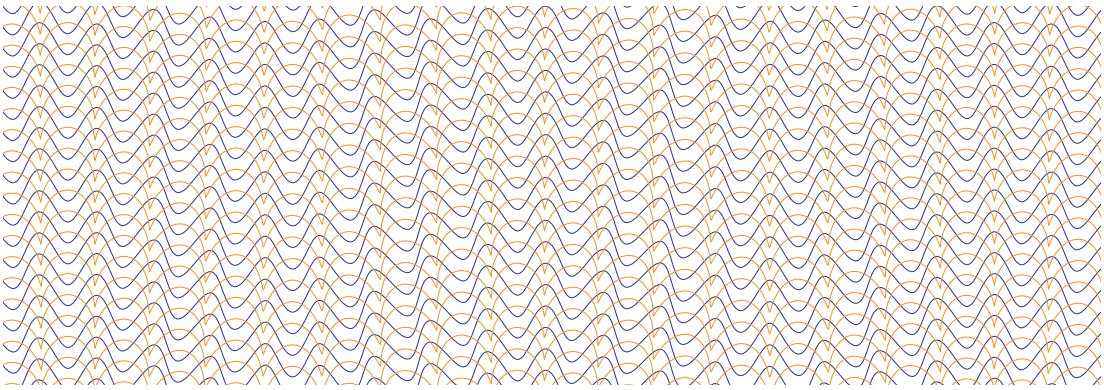
You can zoom to area occupied by these paths in preview document window to check their shape and color at higher magnification value:



After that switch to to **Path** panel of **Excentro Control** inspector and switch off **Visible** check box of **Line** base object, two border regular elements and **Blend** content element to make their paths invisible. Final background picture should look exactly like one shown at the end of **Case Study** section of this chapter:



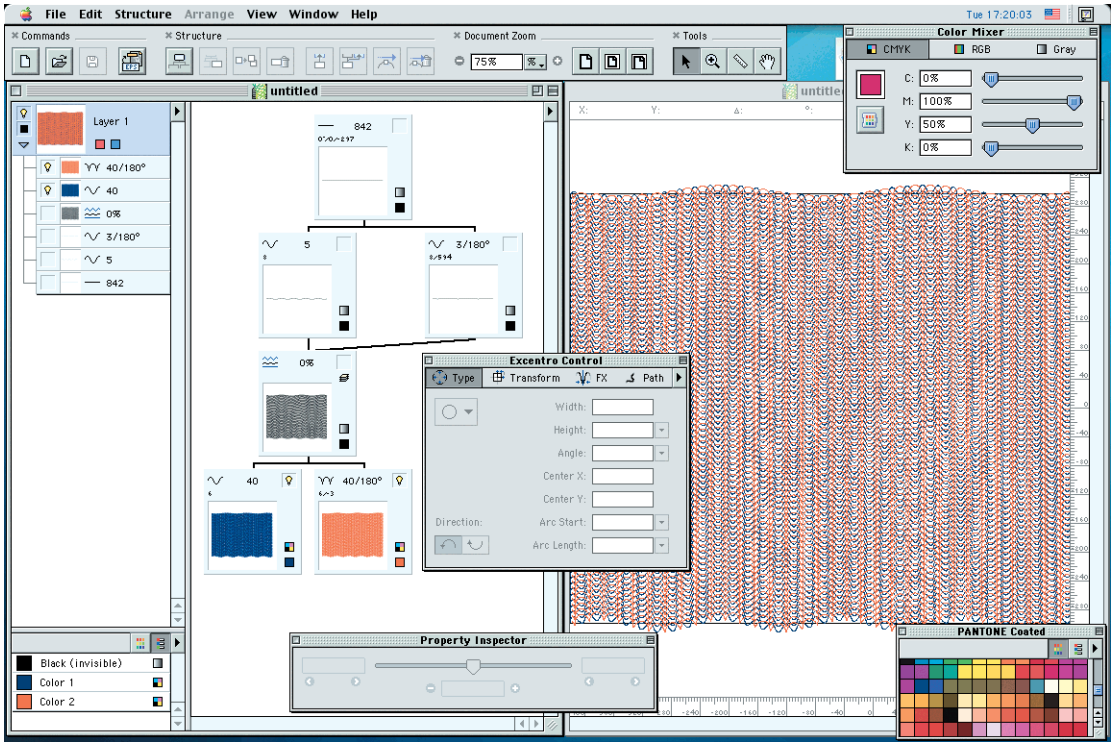
Now you can export this background in *Adobe Illustrator* format using **Export** command from **File** menu and use it as part of certificate, diploma, etc. Below is a part of the background in vector form:



TEMPLATE AND EXAMPLES

Stationary file '**Background Template 2.exc**' from '**Excentro Templates**' folder contains a copy of the document we created in previous section. You can use this template to create new backgrounds by modifying attributes of its objects without a need to reconstruct them in new file as was described above.

■ **Template Usage.** Launch *Excentro* application and open '**Background Template 2.exc**' file. New **untitled** document that contains copy of stationary file content will be opened in front of you:



Save this new document to whatever location on your hard disk you use for guilloche designs giving it meaningful name. Now you can modify objects attributes and create your custom background from this template:

◆ You can change color attributes of the objects. The easiest way to do so is to redefine '*Color 1*' and '*Color 2*' entries in document colors list. Just drag color patch from **Color Mixer** or swatch palette window to color patch (small colored rectangle) of '*Color 1*' or '*Color 2*'. This will automatically change color attributes of all objects that use this colors list entry.

◆ You can modify objects attributes. For example: change of regular element's **Type** attribute will modify its shape making it 'saw-like' or 'tooth-like' instead of wavy; change of element's **Frequency** will add or reduce number of waves or coils its shape has; change of **Side Size** of the **Cycloid** will make its coils smaller or larger, etc. You can modify attributes of both border regular elements and both background regular elements.

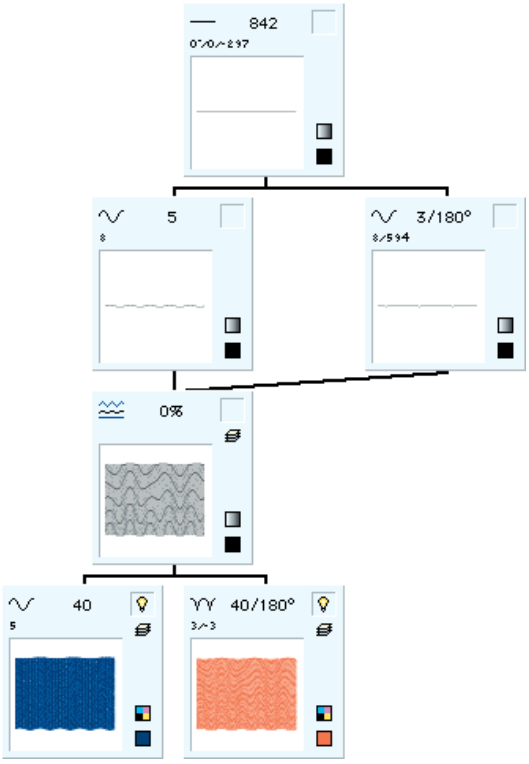
◆ You can add new regular elements objects to **Blend** content element. This will increase number of paths the background consists of making pattern even more complex.

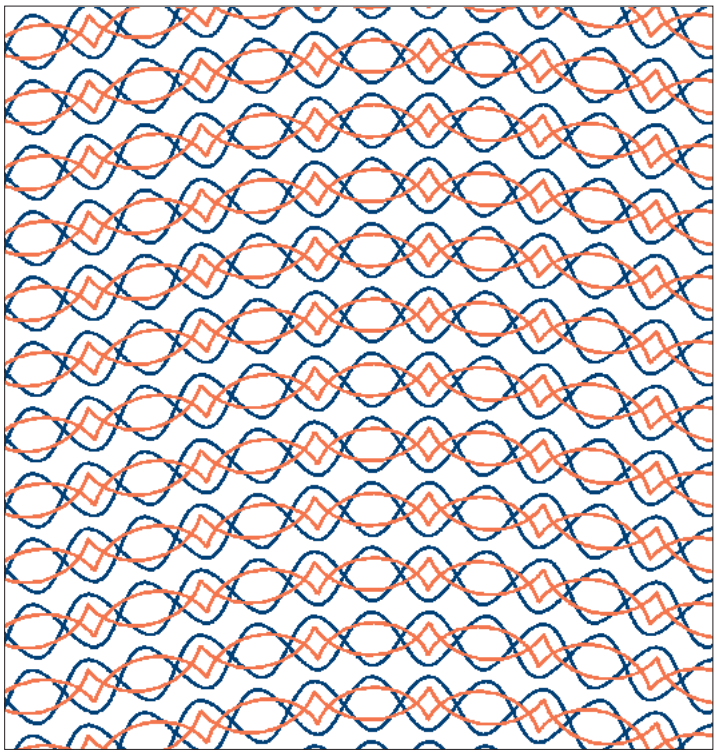
◆ You can modify attributes of Step & Repeat Set changing distance between paths of the background. This will increase or decrease pattern paths 'density'.

Examples of this template usage are located in '**Background Template 2 examples**' folder. They show most typical variations you can create using '**Background Template 2.exc**' template.

■ **Template Examples.** Let us take a quick look at examples of '**Background Template 2.exc**' variations from '**Background Template 2 examples**' folder.

◆ **Example 1:** '**example 1.exc**' file contains background created from '**Background Template 2.exc**' template. In this case we decreased number of steps in Step & Repeat Set and modified background regular elements attributes to add more distance between each copy of background paths, so that they split into distinct stripes (comparing to background paths of original template that intersect to form uniform texture).

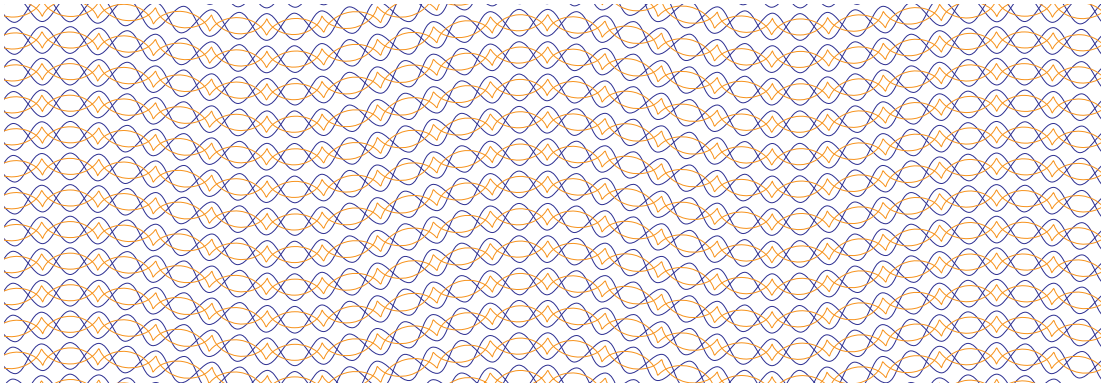




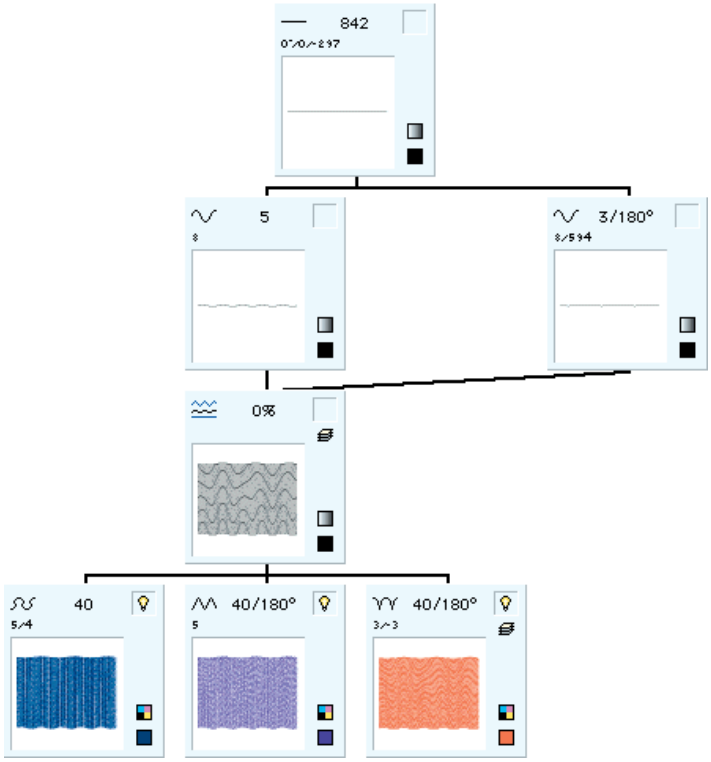
Number of Steps of **Blend** content element's Step & Repeat Set is changed from '*75*' to '*50*'. **Amplitude** of the first background regular element is changed from '*6*' to '*5*', **Amplitude** of the second background element — from '*6*' to '*3*' (to make it appear inside paths of the first element).

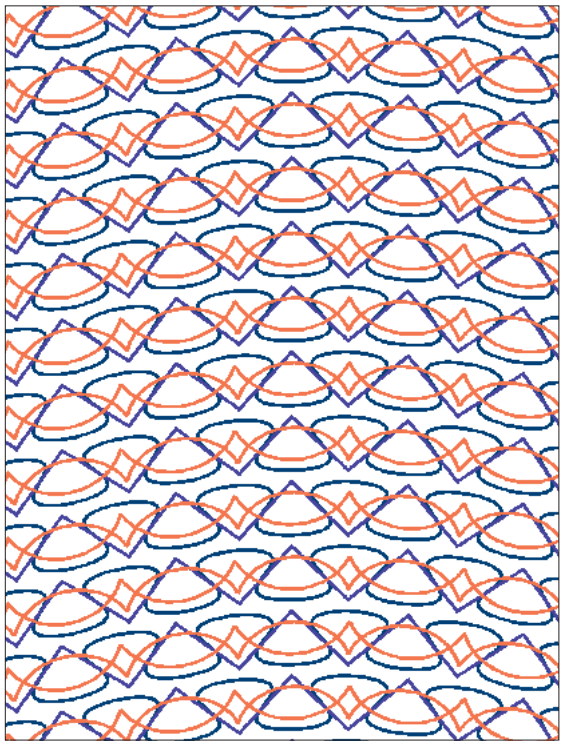
We also added two more paths to the background to make 'stripes' more distinct. Instead of creating new background regular elements we added Step & Repeat Sets to existing elements. These Step & Repeat Sets create one more copy of the path for each regular element with '*180°*' shift of **Phase** attribute value. Step & Repeat Set added to **Cycloid** element also modifies **Side Size** attribute, so that coils of **Cycloid** path copy turns upside down.

Picture below shows part of finished background in vector form:

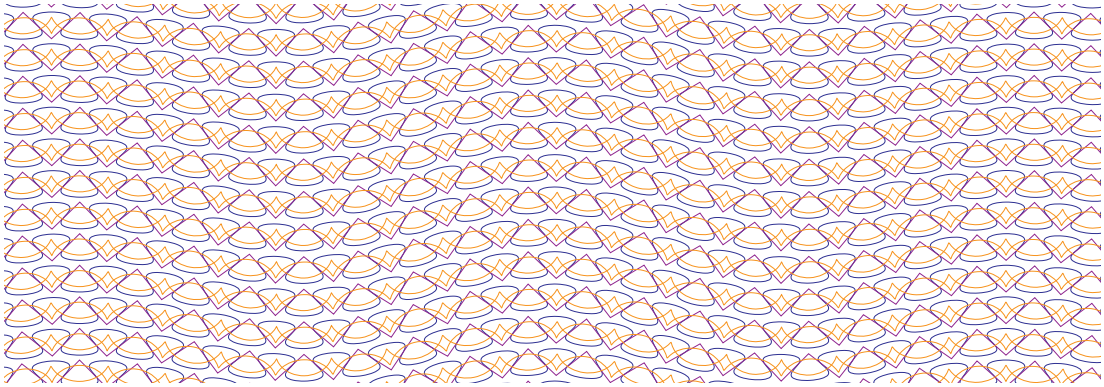


◆ **Example 2:** '**example 2.exc**' file is the modification of '**example 1.exc**'. Step & Repeat Set of the first background regular element is expanded in this example (with **Expand Step & Repeat Set** command from **Excentro Control** window menu). **Type** of two regular elements created after this operation are changed: the first element now is of **Eight** type with **Side Size** attribute set to '*4 pt*', the second element is **Star**.



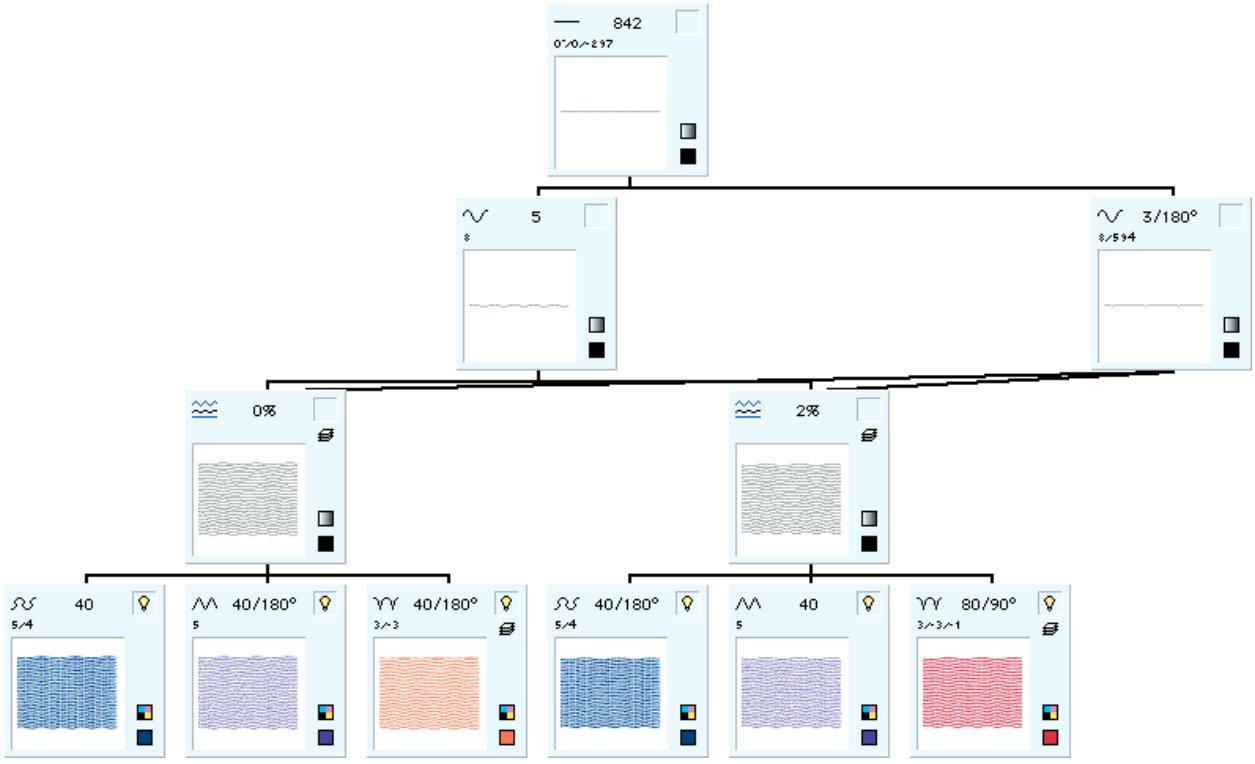


Picture below shows part of finished background in vector form:

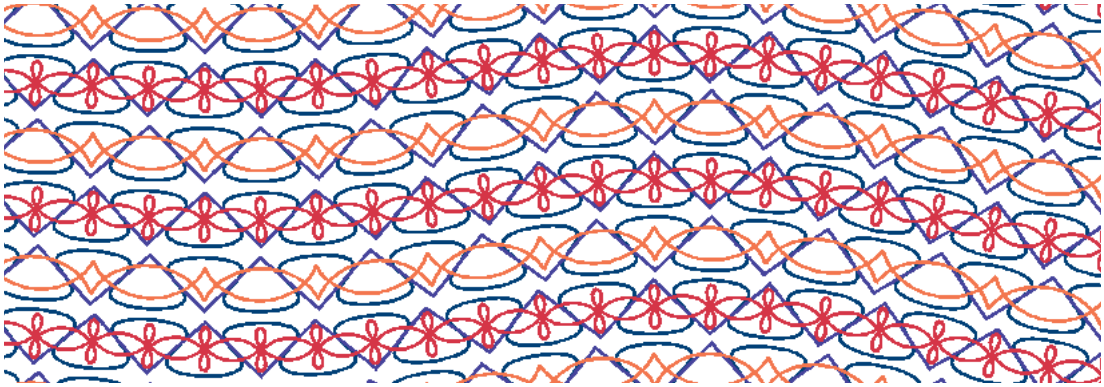


◆ **Example 3:** '**example 3.exc**' file is the further modification of '**example 2.exc**'. Single **Blend** content element is replaced by a pair of elements. Each **Blend** element has Step & Repeat Set with two times lower number of steps than in previous example. Initial **Ratio** value of the second **Blend** element is set to '*2*'. As a result combination of two **Blend** elements paths compose a uniform background identical to that of original single **Blend** element.

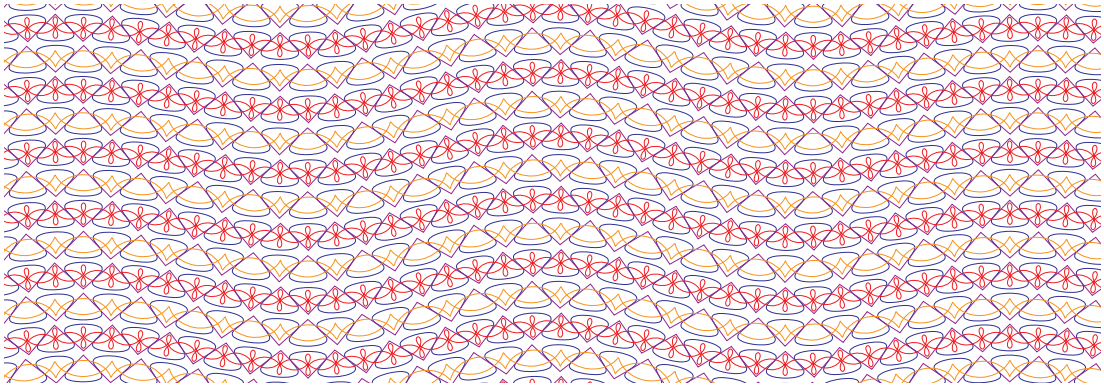
The reason for this change was to split background in two parts with slightly different attributes of regular elements that use each **Blend** element as a parent. Attributes of regular elements from the first part are the same as in '**example 2.exc**'. **Phase** attributes of the first two regular elements from the second part are shifted by 180°, so waves of these paths appears to be opposite to waves of the same elements from the first part of the background. **Frequency** of the third regular element (**Cycloid**) from second part is made two times higher than that of the third regular element from the first part of the background. **Base Offset** of this element is set to '*–1 pt*', this way paths of this element produce interesting pattern that looks like intersecting vertical and horizontal 8-like figures.



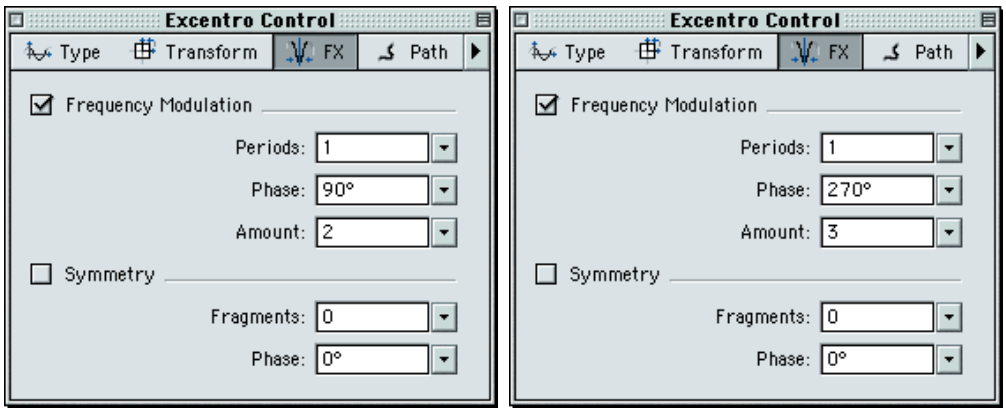
Magnified picture of this background part:



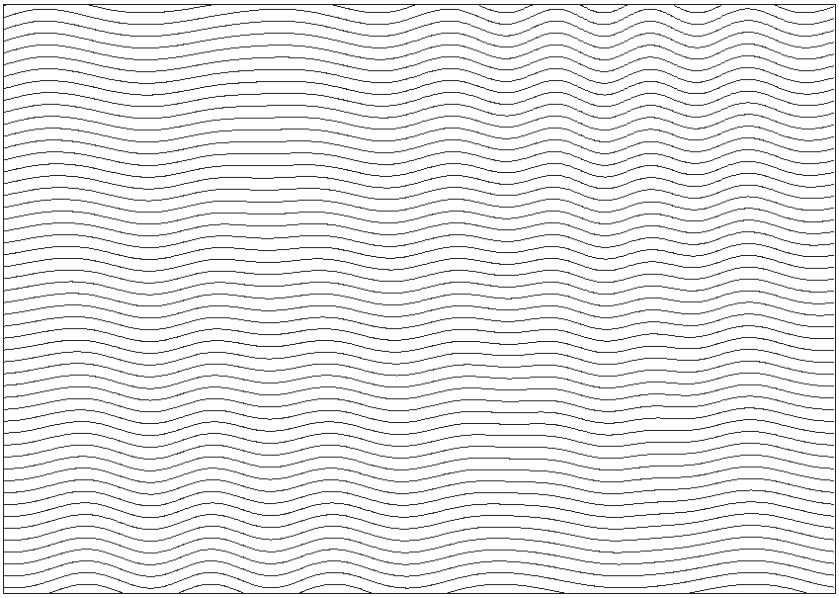
Part of finished background in vector form:



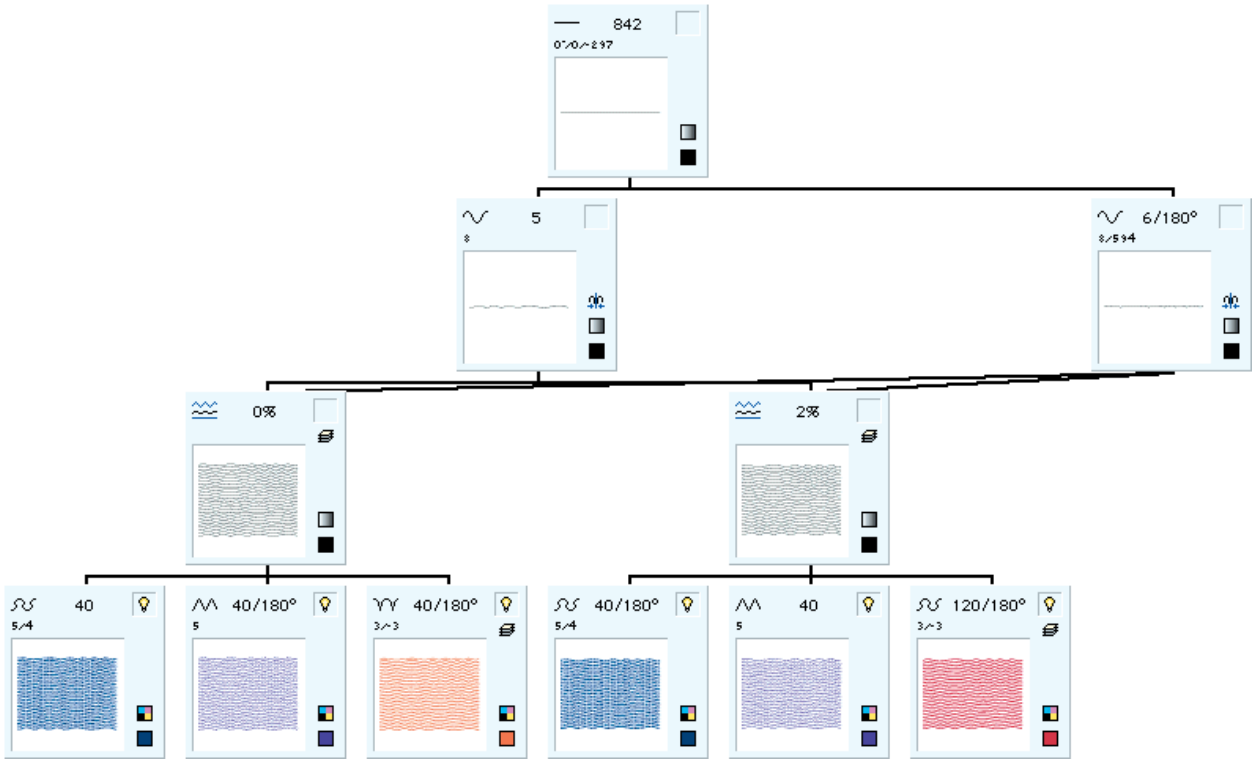
◆ **Example 4:** '**example 4.exc**' file adds **Frequency Modulation** effects to border regular elements of '**example 3.exc**'. The first element has **Frequency Modulation** with following attributes: **Periods** = '*1*', **Phase** = '*90°*', **Amount** = '*2*'. This increases **Frequency** attribute of **Sine Wave** to '*7*' in the first quarter of the path and decreases it to '*3*' in the last quarter of the path. The second element has **Frequency Modulation** with following attributes: **Periods** = '*1*', **Phase** = '*270°*', **Amount** = '*3*'. **Frequency** attribute of this **Sine Wave** decreases to '*3*' from its initial value of '*6*' in the first quarter of the path and increases it to '*9*' in the last quarter of the path.



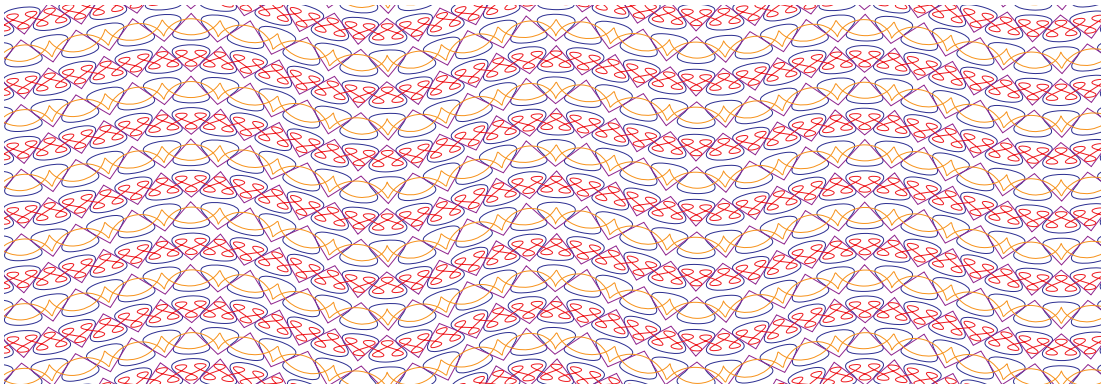
After this change was applied to border regular elements, shape of paths of **Blend** content elements became even more complex and variable than before (see illustration on next page).



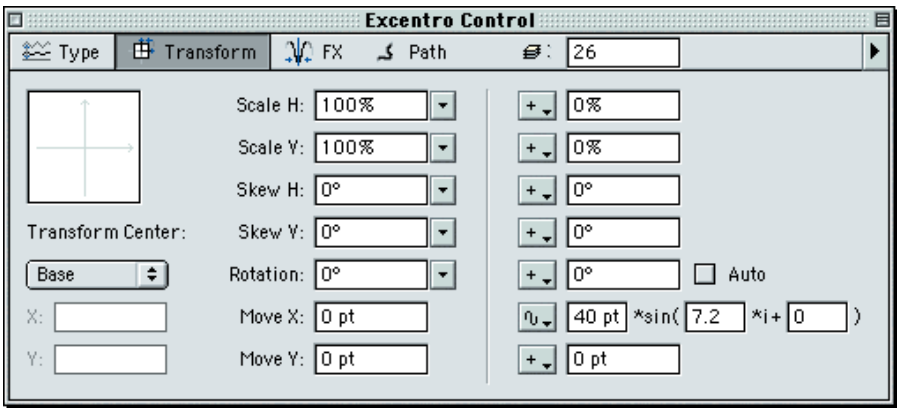
Guilloche structure of this example:



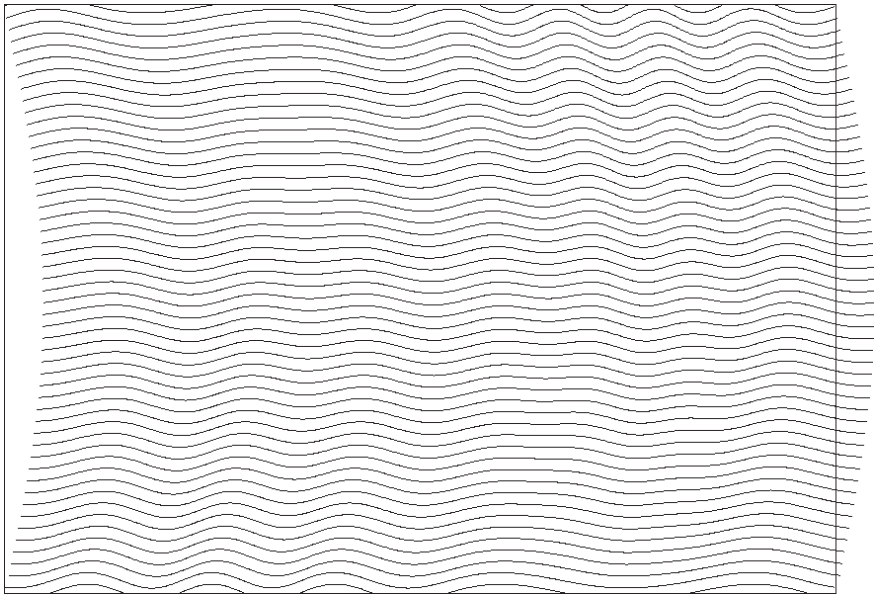
Picture below shows bottom part of finished background in vector form:



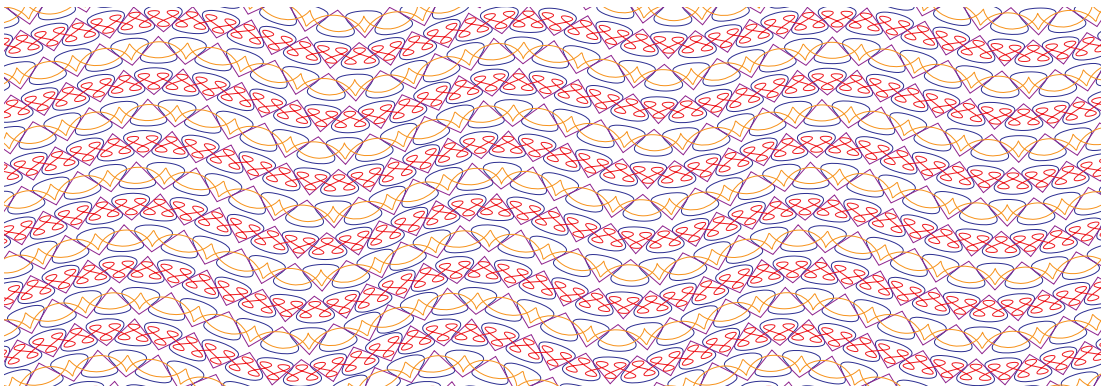
◆ **Example 5:** '**example 5.exc**' adds **Move X** attribute modification to Step & Repeat Sets of **Blend** content elements. This modification uses **Sine** type of **Increment**, this way paths in top and bottom areas are not changed and paths in central area have maximum horizontal shift of '*40 pt*':



After **Move X** attribute modification was applied the shape of **Blend** content element paths achieved another degree of complicity. Please, be aware that because of horizontal shift paths of the background no longer fill the exact document size. To cover whole A4 size rectangle you should make path of **Line** base object longer by modifying its **Length** attribute.



Picture below shows bottom part of finished background in vector form:



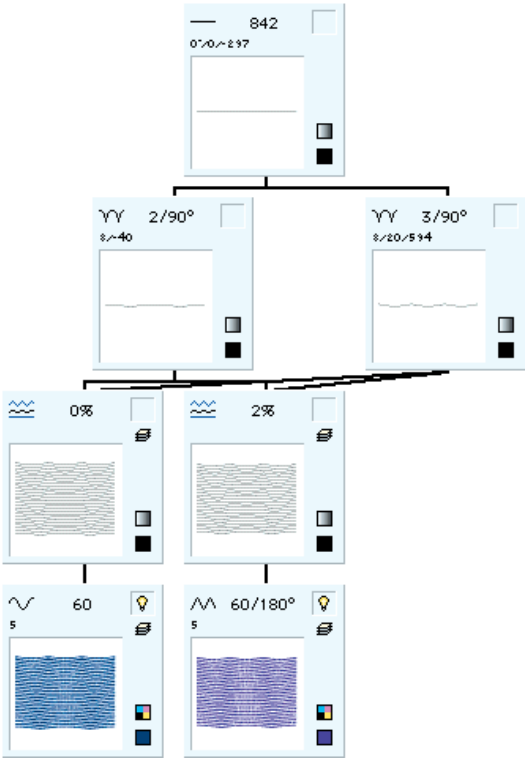
◆ **Example 6:** '**example 6.exc**' illustrates another case of border regular elements attributes variation. This time we changed **Type** of these two elements to '*Cycloid*'. Bottom element has attributes:

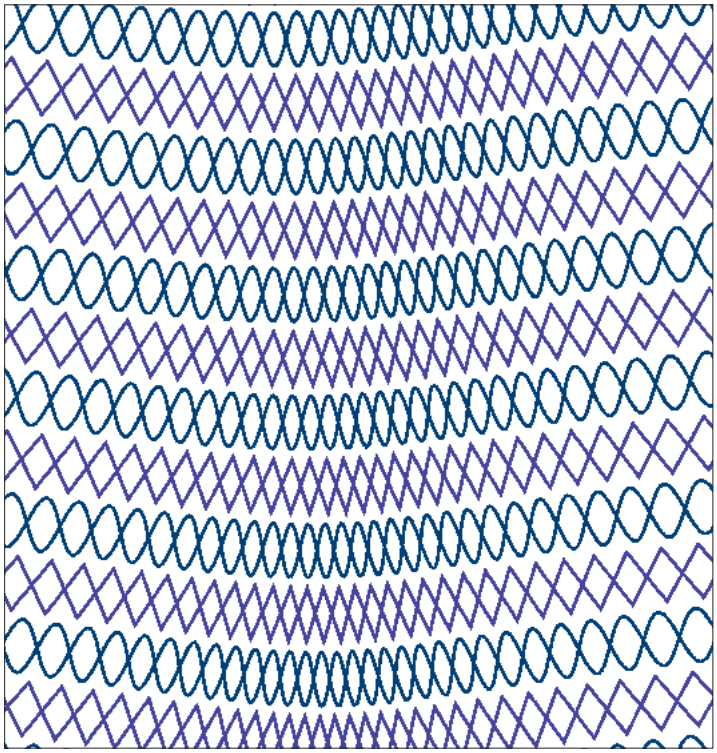
Frequency = '*3*', **Phase** = '*90°*', **Side Size** = '*20 pt*'

Top element:

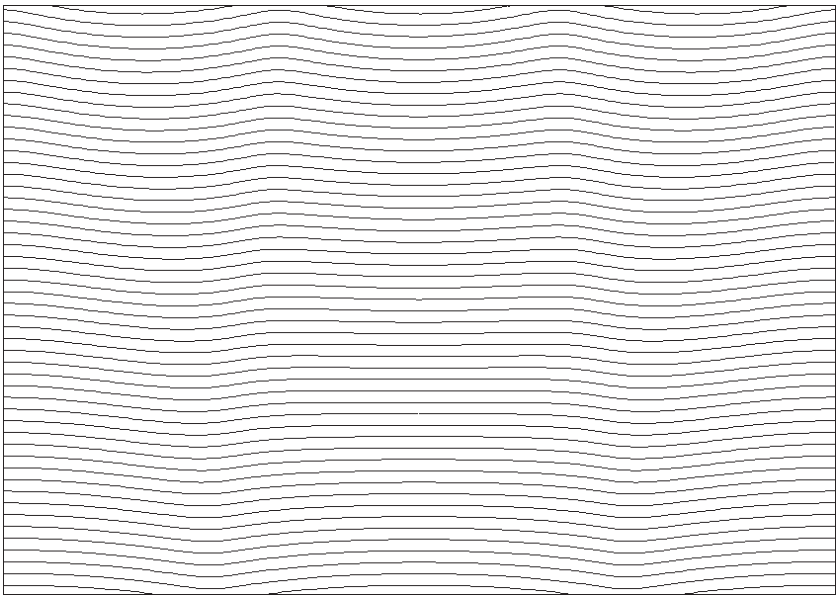
Frequency = '*2*', **Phase** = '*90°*', **Side Size** = '*–40 pt*'

Regular elements that form texture of the background have Step &Repeat Sets which produce 2 paths at once (just like in '**example 1.exc**' file). The first element is **Sine Wave**, the second element is **Star**.

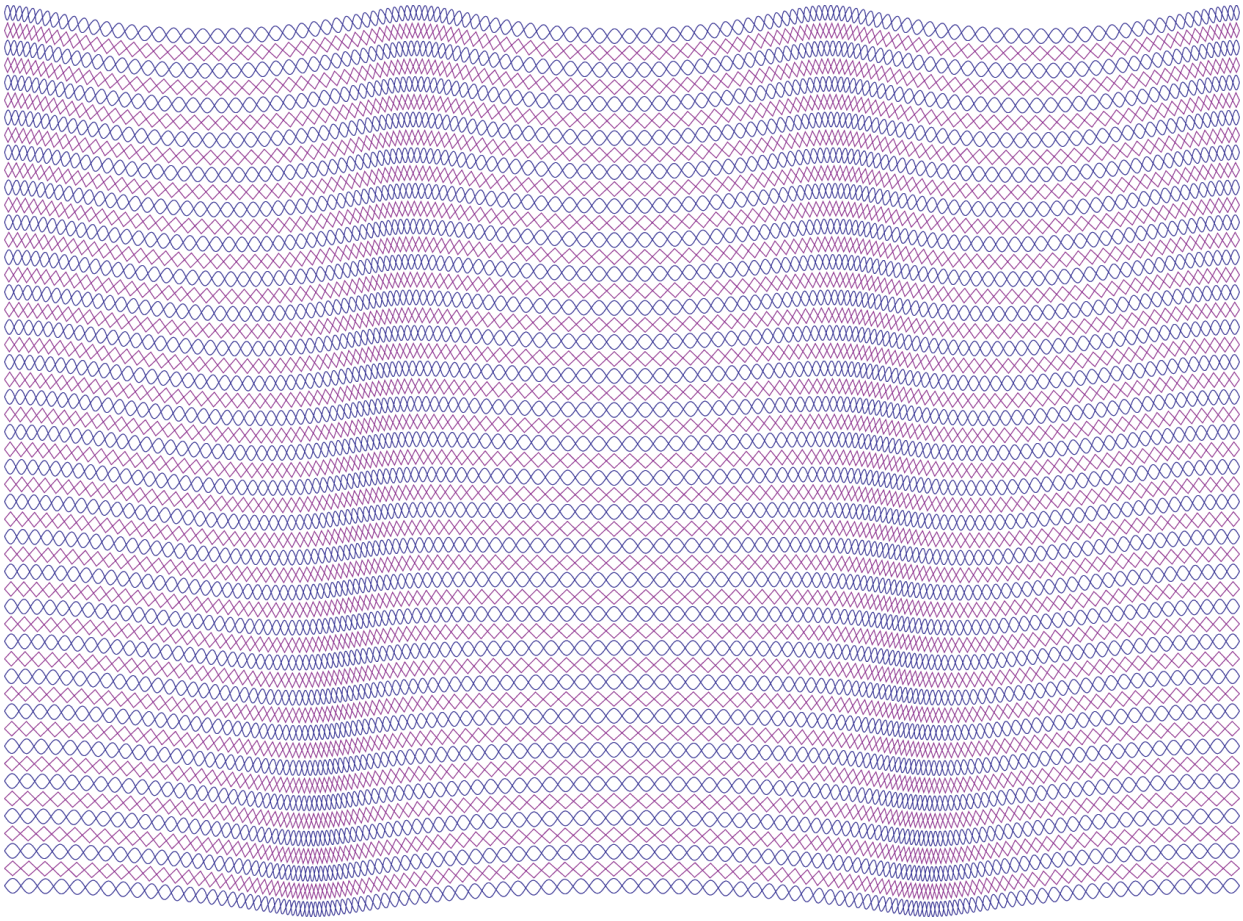




This is more extreme modification of border shapes than in '**example 4.exc**'. As a result paths of **Blend** content elements produce more interesting pattern that looks like 3-D relief resembling a picture of 'curtain' or 'sheet' of fabric.



Following picture shows an image of the finished background (this picture was scaled to fit the page of this book).

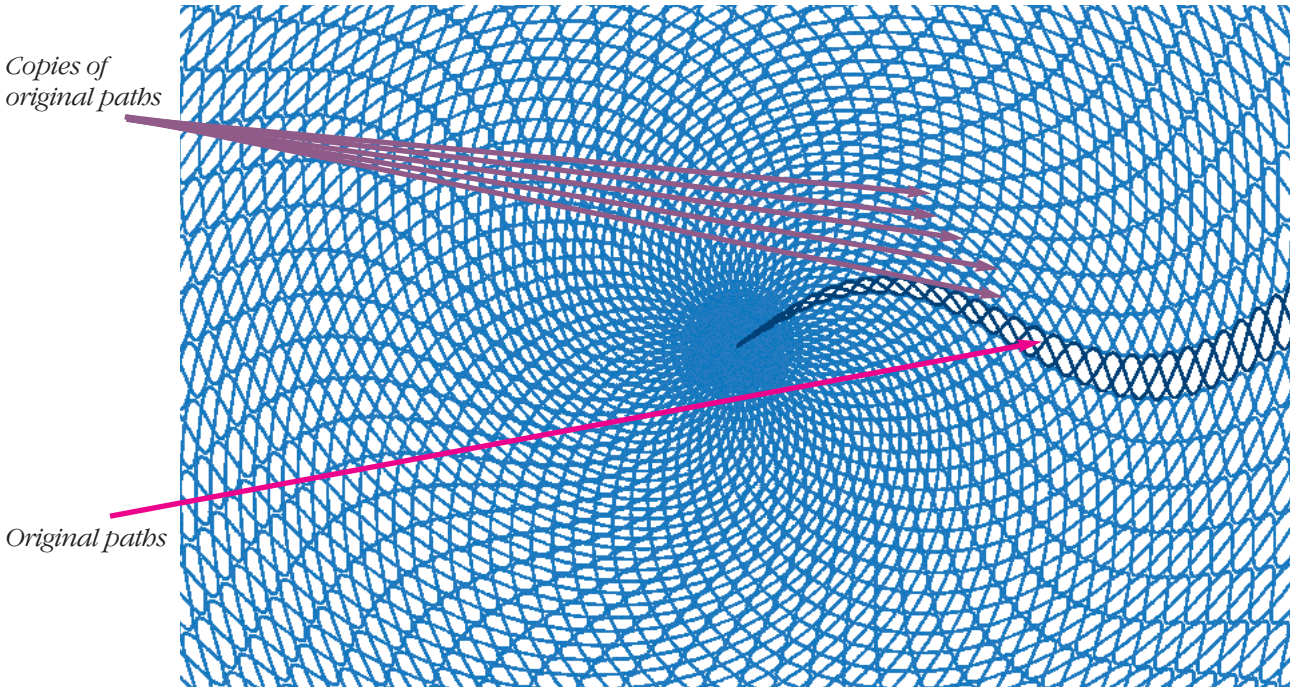


CHAPTER 4: RADIAL BACKGROUNDS

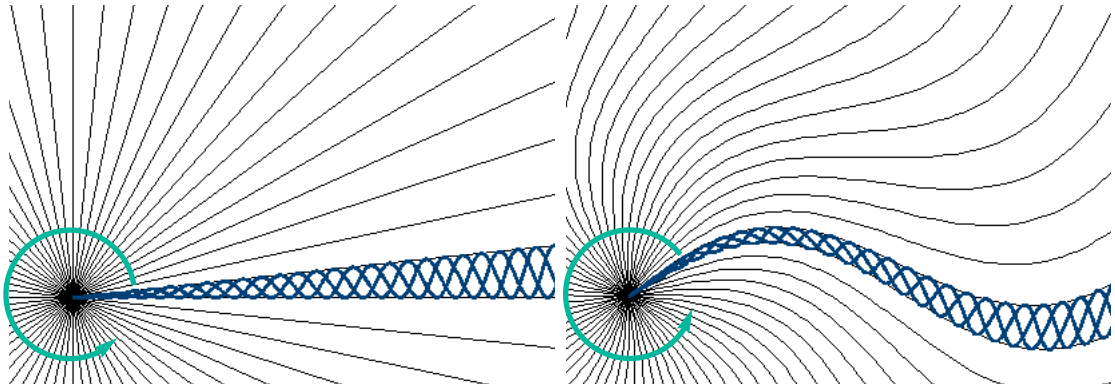
This chapter explains how to create radial backgrounds — intriguing patterns that could be constructed using only four *Excentro* objects and two Step & Repeat Sets. Example we will construct in this chapter is the same as that of stationary file '**Background Template 3.exc**' from '**Excentro Templates**' folder. You can use this template to create new radial backgrounds by modifying attributes of its objects without a need to reconstruct them in new file following all steps described below.

CASE STUDY

Similar to classic linear backgrounds that are constructed from few original paths duplicated with some vertical offset value, radial backgrounds also consist of several original paths, but this time the paths are duplicated by rotation around a fixed center point. Following picture illustrates the case of typical radial background:



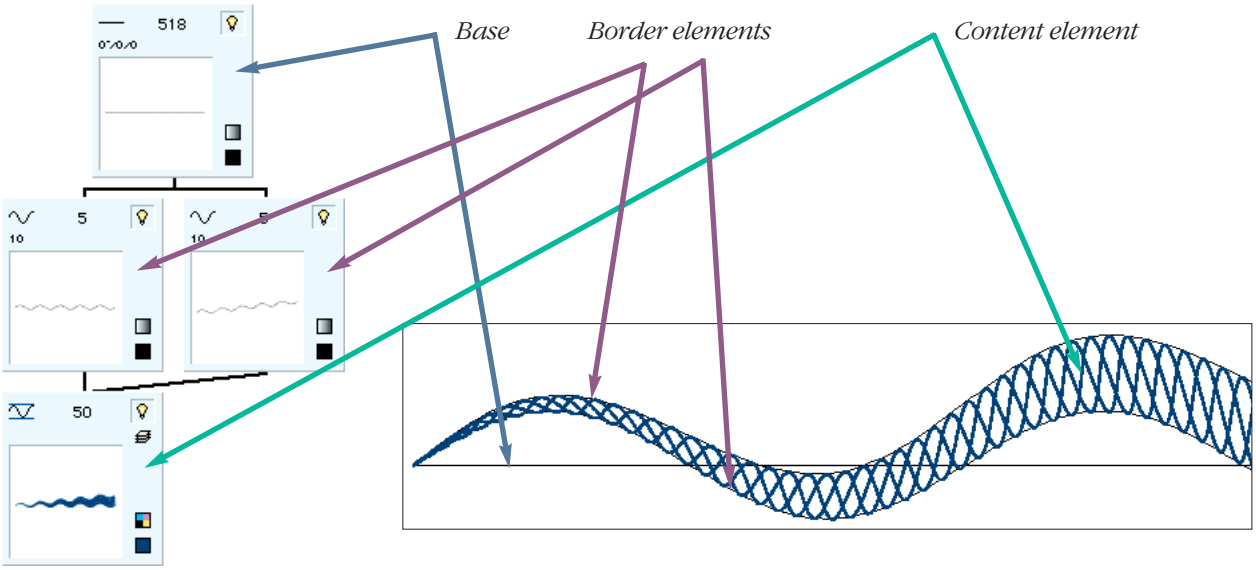
To create a radial background we should start with single sector of a circle filled with original paths of the background and then repeat this sector using Step & Repeat Set modifiers for a number of times required to complete a circle and fill area of the background. Because normal sectors formed by two straight line radii (see left picture below) do not provide wide enough field for experiments we will use 'free-form' sectors formed by two wavy paths (on right picture):



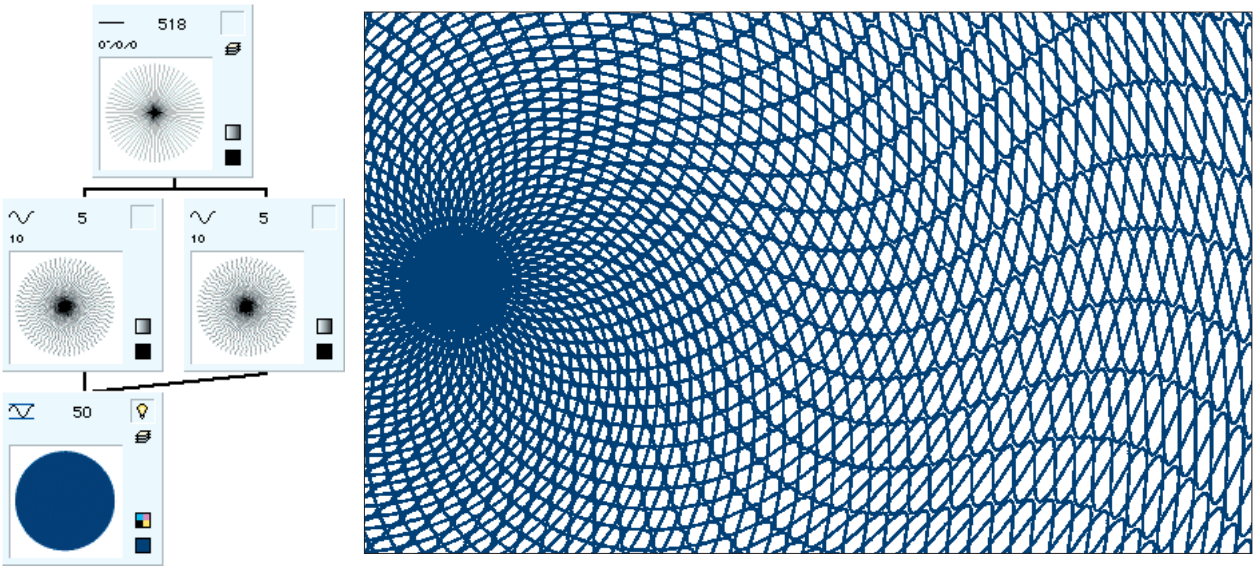
The top border path of our 'free-form' sector should be the exact copy of the bottom path rotated around its starting point on some small degree angle. Otherwise, if these paths would be of different shape, there will appear some white space between adjacent sectors, because top border of the first sector will not coincide with bottom border of the next copy of this sector after circular duplication.

So, to make a single sector of our radial background we should create the first border wavy path, then make its copy rotated around the starting point of the path, after that we should fill area between these borders with paths that will form a texture of our background (using object of content elements class).

To construct border paths we will use base object of **Line** type. This base object can be specified using following attributes: **Start** point, **Length** and **Angle** of rotation — these attributes will be sufficient to define size of our radial background, its center point and attributes of Step & Repeat Set circular duplication. Guilloche structure of single sector design with two wavy border paths and single content element is shown below:



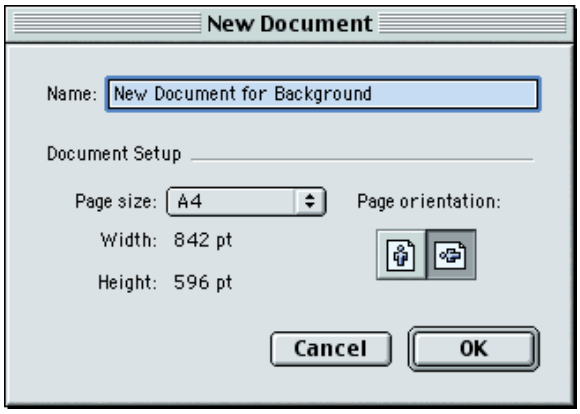
When we have a single sector of future radial background finished, all is left to do to complete the design is to create copies of the sector by applying Step & Repeat Set modifiers to **Angle** attribute of **Line** base object (the value of increment should be the same or close to that of the sector angle between two border paths). As the finishing touch we should switch off visibility of paths others than that of content element and the radial background is ready.



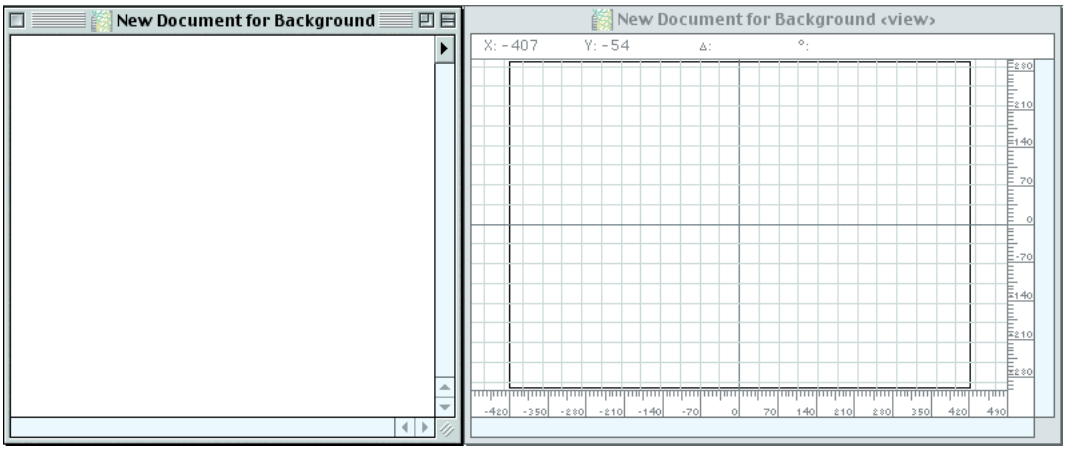
STEP BY STEP BACKGROUND CREATION

Below we provide the detailed description of all steps required to create this background.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Select proper predefined document size from pop-up menu or enter custom size in **Width** and **Height** fields. To simplify work and graphics preview new document should have the same size as the background you want to create. In this example we will try to create background of '*A4*' size with '*Landscape*' orientation that could be used for standard diploma or certificate.



Click **OK** button and two windows of new document will appear in front of you.



■ **Step 2: Line Base Object.** To fill all area of A4 size document with sectors of radial background, we should start single sector creation with base object of **Line** type that has **Start** point in the center of the document and **Length** attribute equal to the distance between the center point and the corners of the document.

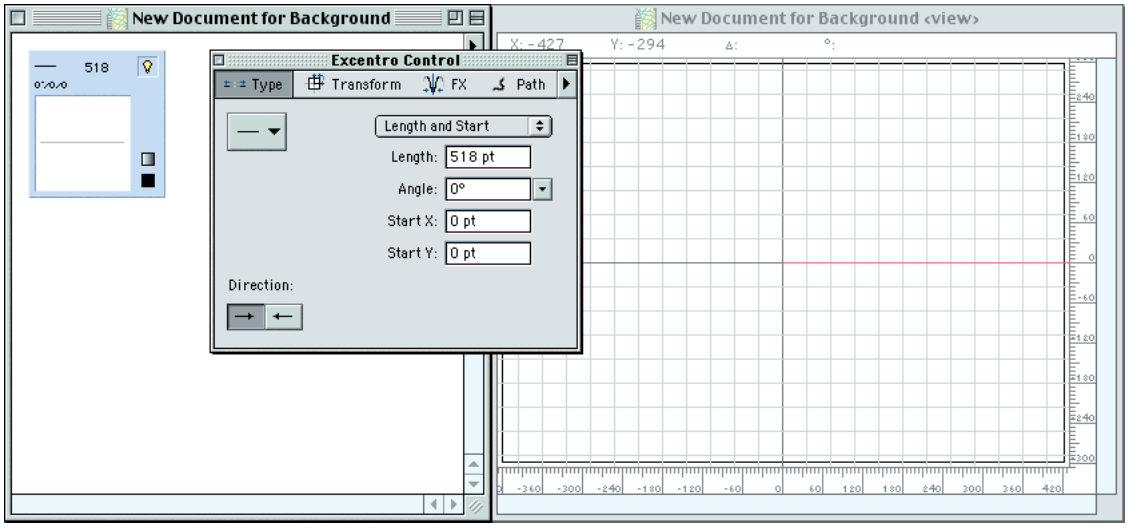
Choose **New Base** command from **Structure** menu to create new base object. After that in **Excentro Control** inspector choose following options:

- '*Line*' from **Type** pop-up menu
- '*Length and Start*' from Line options pop-up menu

Enter following attributes in appropriate fields of **Excentro Control** inspector:

- **Length** = '*518 pt*' (calculated distance from the center of the document to document's corner)
- **Angle** = '*0°*' (this is the first sector of our background)
- **Start X** = '*0 pt*' (horizontal center position in the document)
- **Start Y** = '*0 pt*' (vertical center position in the document)

Base creation is finished, you should get following picture on your screen (preview of base line is shown with red in document preview window because it is the selected object):



■ **Step 3: Top and Bottom Border Elements.** Now we shall create two wavy paths that will form borders of our first sector.

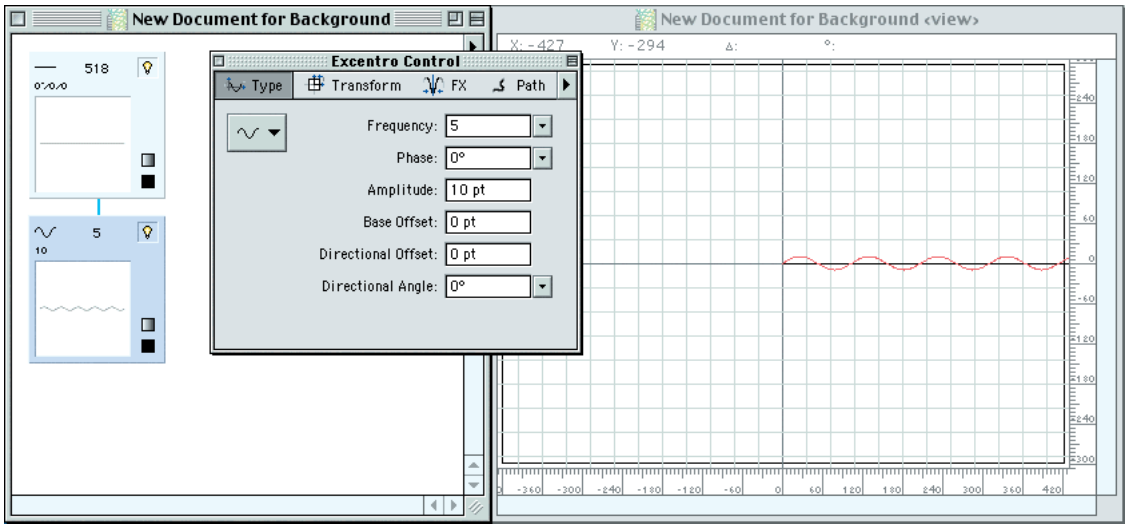
First Element: Select base object we created in step above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Frequency** = '*5*' (we do not need a lot of waves for border paths)
- **Phase** = '*0°*' (default initial value, no need to change it)
- **Amplitude** = '*10 pt*' (default initial value is good enough)
- **Base Offset** = '*0 pt*' (default initial value)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

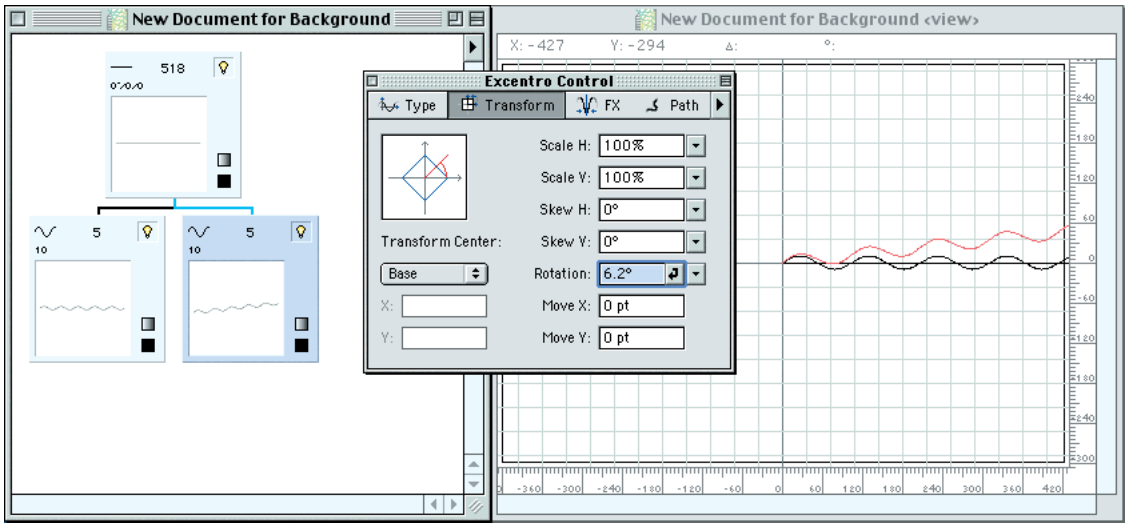
First border path is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):



Second Element: Since the second border element should be a rotated copy of the first one, let us create it by duplicate operation. Select the regular element we created above and choose **Duplicate** command from **Structure** menu to create a copy of regular element. After that in **Excentro Control** inspector switch to **Transform** panel and enter following value for **Rotation** attribute:

- **Rotation** = '*6.2°*' (we will create our radial background by duplicating this sector 60 times with rotation angle of '*6°*': 60 • 6° = 360°; we will make sector angle slightly larger than '*6°*' to make paths of adjacent sectors closer to each other without any white borders between sectors)

Other attributes should remain without changes as that of the first element. Both elements are ready. You should get following picture on your screen (preview of the second path is shown with red because it is the selected object):



■ **Step 4: Background Content Element.** Now we shall create content element between two border paths that will form radial paths pattern of our background.

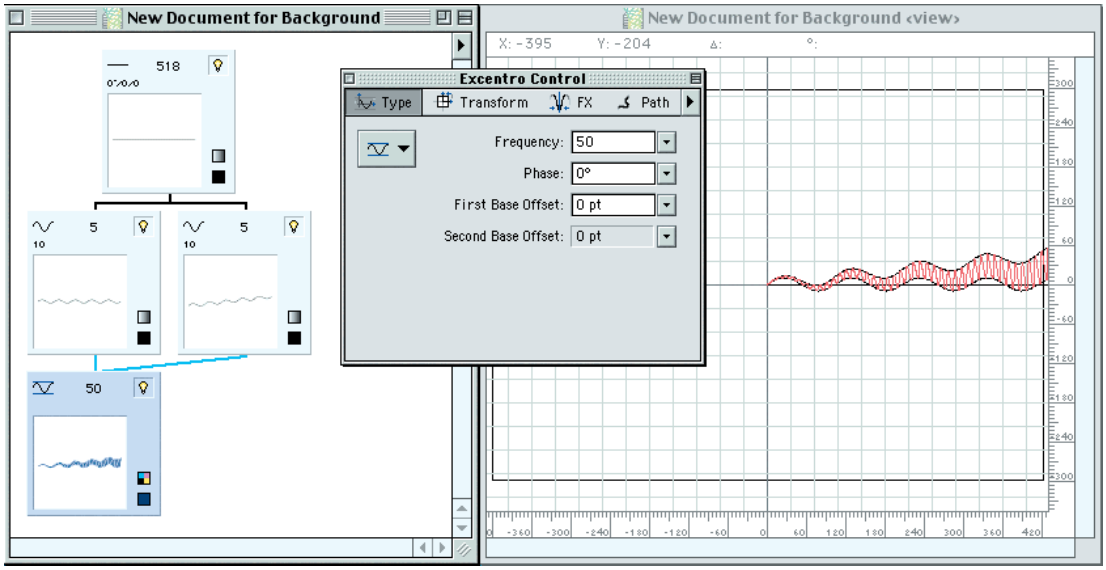
Select the first border regular element with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the second border regular element. Rectangular representation of the first clicked element in main document window should become blue (color for selected object), rectangular representation of the second element should become reddish (color for second selected object). Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

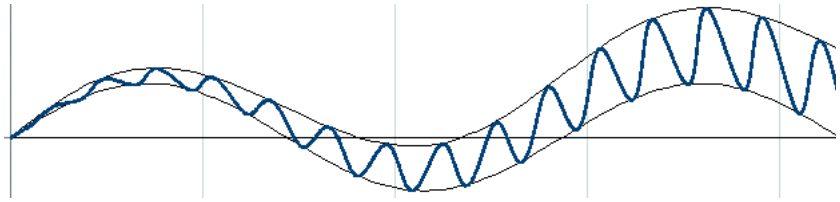
- **Frequency** = '*50*' (this is the element that create background paths, we need a lot of waves to make a pattern with sufficient paths 'density')
- **Phase** = '*0°*' (default initial value, no need to change it, Step & Repeat Set will do it for us in next step of this background creation)
- **First Base Offset** = '*0 pt*' (default initial value)
- **Second Base Offset** = '*0 pt*' (default initial value)

You should get following picture on your screen (see next page). Preview of content element's path is shown with red because it is the selected object, its path touches paths of both border elements at maximum and minimum values of **Sine Wave** because **First Base Offset** and **Second Base Offset** are set to '*0 pt*':

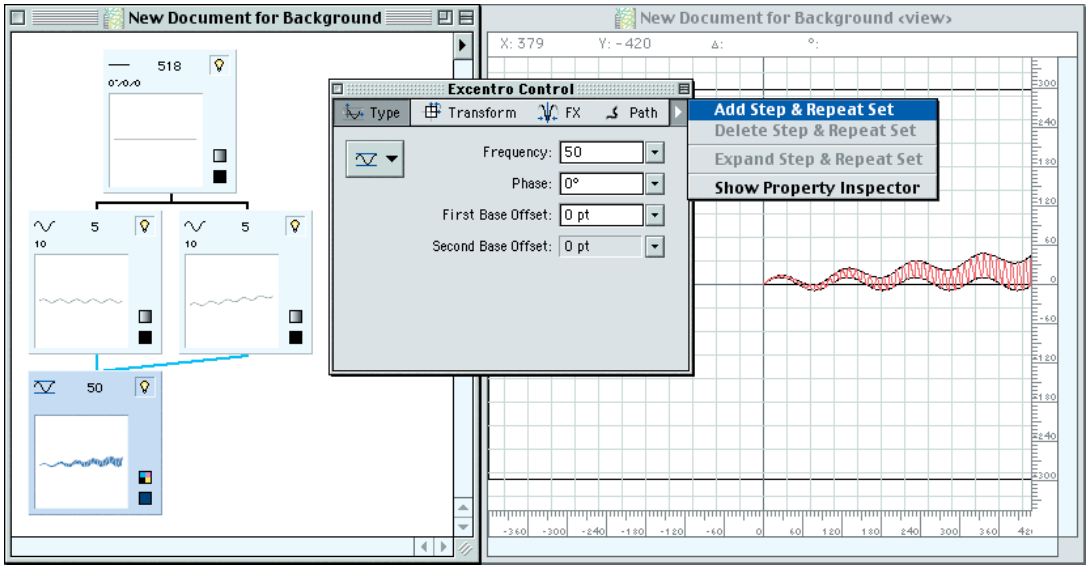


Let us apply stroke and color attributes to the path of the background content element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points (we want background paths to become visible, but not too thick, so other graphics and text placed above this background will remain readable). Mix appropriate color in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control** (for example, let it be some blue color).

You can zoom to area occupied by new path in preview document window to check its shape and color at higher magnification value:



■ **Step 5: Step & Repeat Set of Content Element.** To add more paths to the sector of radial background we will apply Step & Repeat Set modification to the content element we created in the previous step. Select the content element with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu (button with triangle in top right corner of the window).

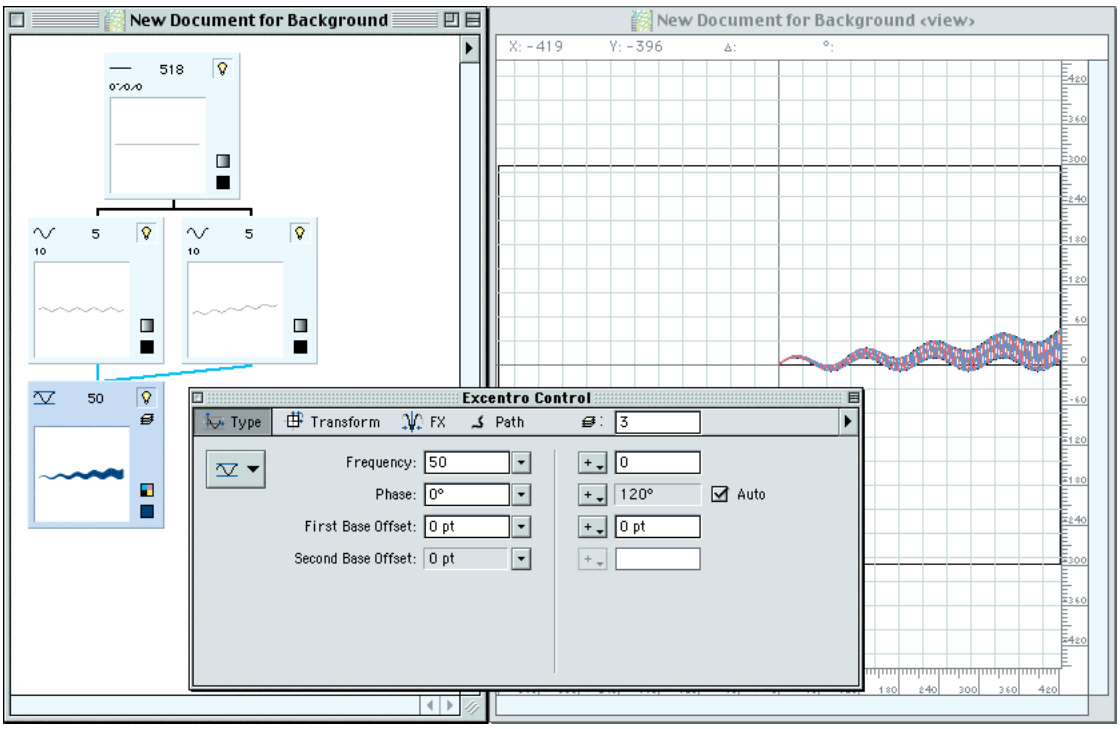


New Step & Repeat Set will be added to the object. Enter following values in Step & Repeat Set fields:

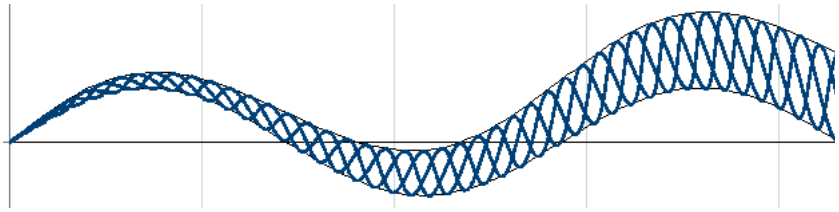
◆ **Number of Steps** = '*3*' (this will make a set of 3 paths: original path of the content element and 2 additional copies)

◆ **Phase** — click **Auto** checkbox beside numeric field and **Phase** attribute value will be automatically calculated so that 3 paths of the content element cover whole [0°; 360°] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



You can zoom to area occupied by content element's paths in preview document window to check new paths of Step & Repeat Set at higher magnification value:



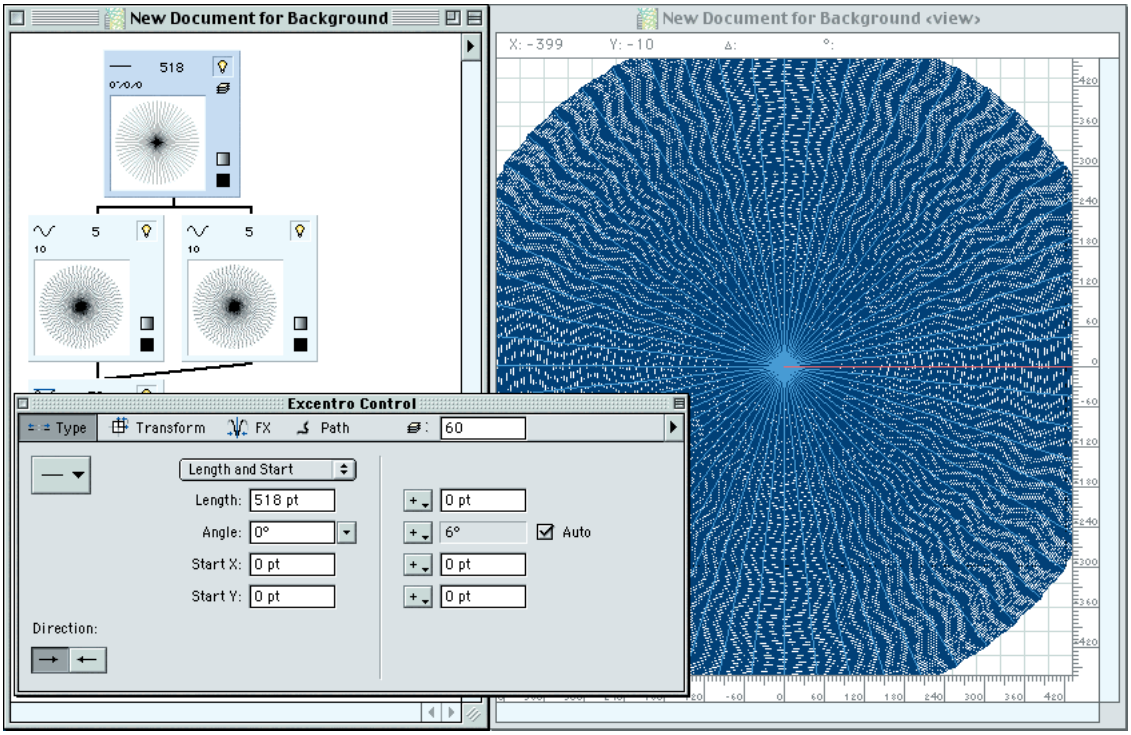
■ **Step 6: Final Step & Repeat Set.** We finished with single sector creation. Now let us apply Step & Repeat Set to **Line** base object that will rotate the sector around its starting point and complete our radial background.

Select **Line** base object with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu. New Step & Repeat Set will be added to the object. Enter following values in Step & Repeat Set fields:

◆ **Number of Steps** = '*60*' (this will make 59 additional copies of the sector)

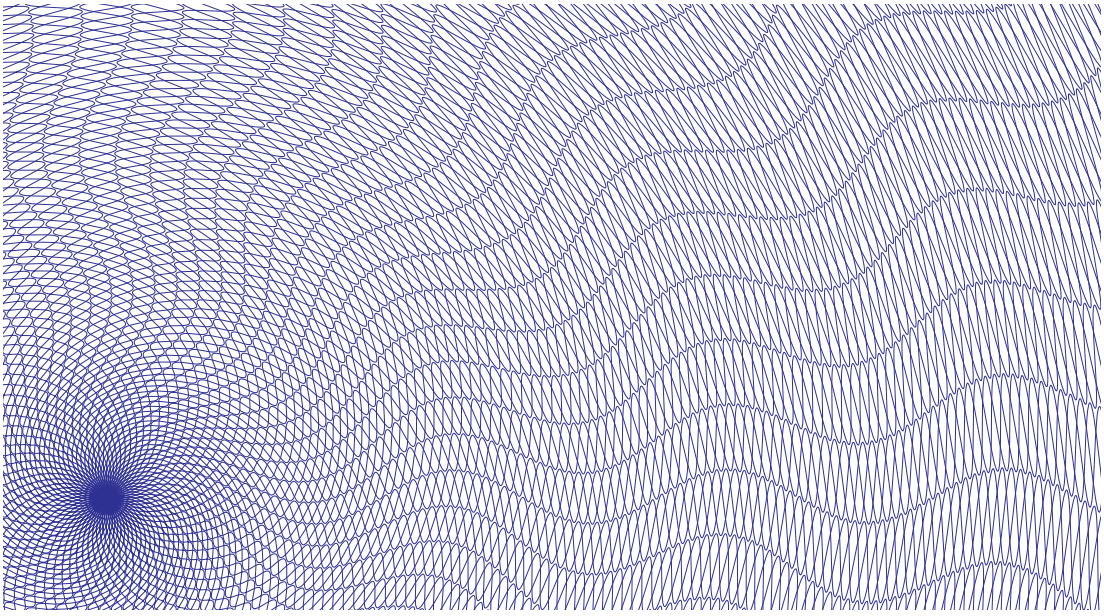
◆ **Angle** — click **Auto** checkbox beside numeric field and **Angle** attribute value will be automatically calculated so that 60 sectors will cover whole [0°; 360°] circle interval (simple arithmetic shows that **Angle** value will be set to 360°/60 = 6°)

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



After that switch to to **Path** panel of **Excentro Control** inspector and switch off **Visible** check box for **Line** base object and for two border regular elements to make their paths invisible. Final background picture should look exactly like one shown on the first pages of this chapter.

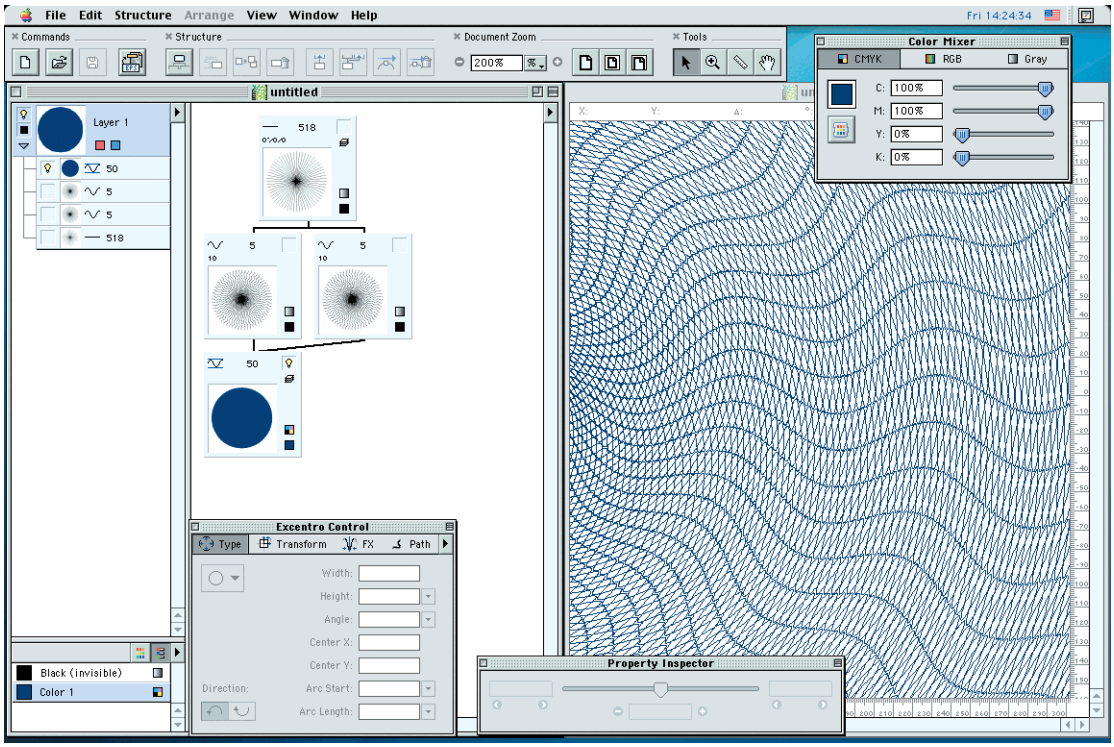
Now you can export this background in *Adobe Illustrator* format using **Export** command from **File** menu and use it as part of certificate, diploma, etc. Parts of the background that protrude outside A4 document size will be clipped off by document's Bounding Box parameter in the exported file. Below is the top right part of the background in vector form:



TEMPLATE AND EXAMPLES

Stationary file '**Background Template 3.exc**' from '**Excentro Templates**' folder contains a copy of the document we created in previous section. You can use this template to create new backgrounds by modifying attributes of its objects without a need to reconstruct them in new file as was described above.

■ **Template Usage.** Launch *Excentro* application and open '**Background Template 3.exc**' file. New **untitled** document that contains copy of stationary file content will be opened in front of you:



Save this new document to whatever location on your hard disk you use for guilloche designs giving it meaningful name. Now you can modify objects attributes and create your custom background from this template:

◆ You can change color attribute of the objects. The easiest way to do so is to redefine '*Color 1*' entry in document colors list. Just drag color patch from **Color Mixer** or swatch palette window to color patch (small colored rectangle) of '*Color 1*'. This will automatically change color attributes of objects that use this colors list entry.

◆ You can modify objects attributes. For example: change of object's **Type** will modify its shape making it 'saw-like' or 'tooth-like' instead of wavy; change of object's **Frequency** will add or reduce number of waves or coils its shape has; change of **Side Size** of the **Cycloid** will make its coils smaller or larger, etc.

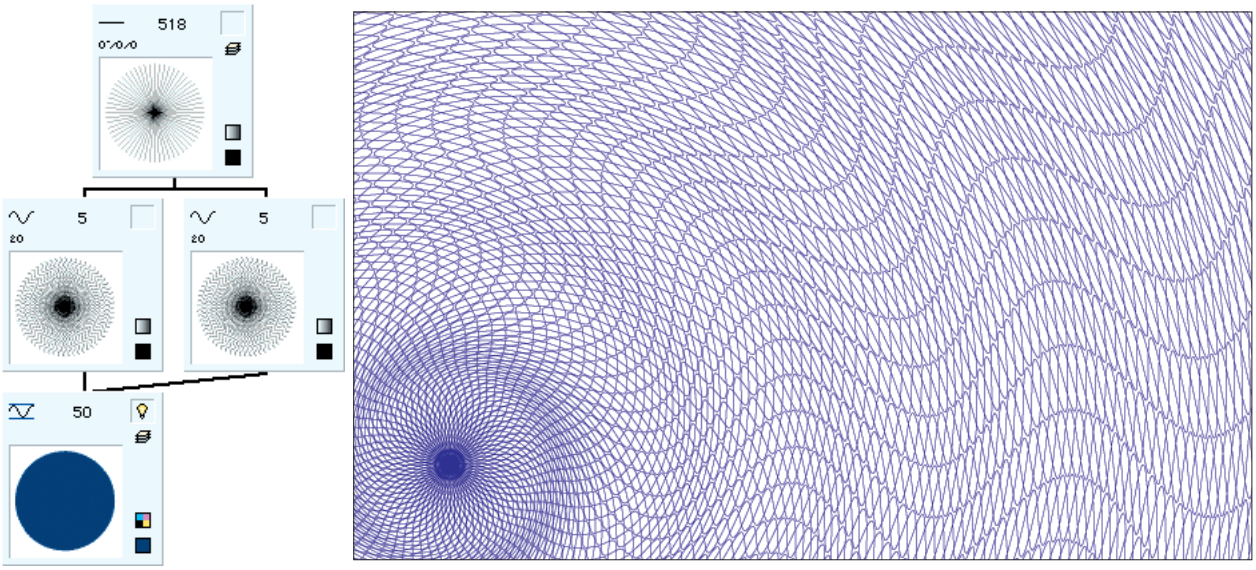
◆ You can add new content elements to the background. This will increase number of paths the background consists of making pattern more complex and interesting.

◆ You can modify attributes of Step & Repeat Sets changing number of sectors that form the background.

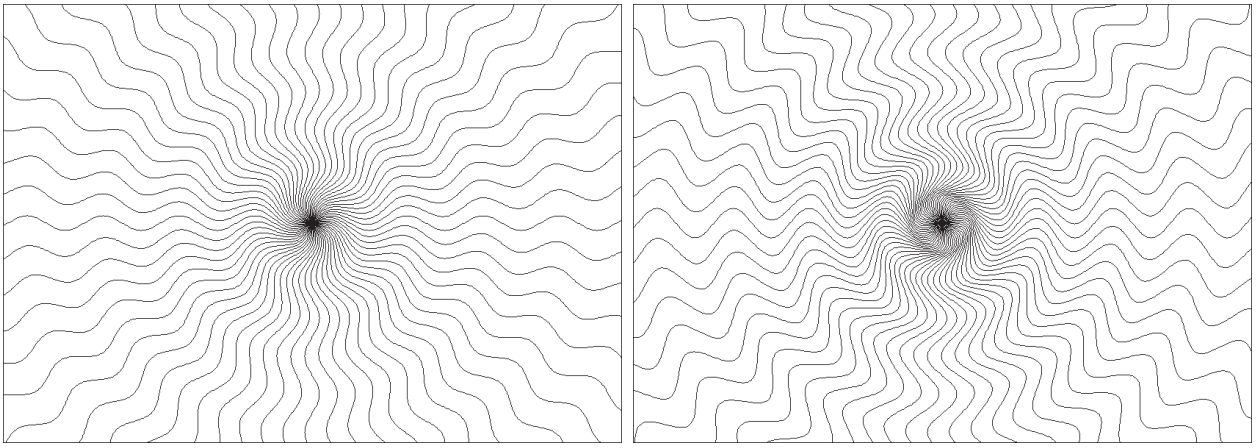
Examples of this template usage are located in '**Background Template 3 examples**' folder. They show most typical variations you can create using '**Background Template 3.exc**' template.

■ **Template Examples.** Let us take a quick look at examples of '**Background Template 3.exc**' variations from '**Background Template 3 examples**' folder.

◆ **Example 1:** '**example 1.exc**' file contains background created from '**Background Template 3.exc**' template by changing **Amplitude** attribute of both border regular elements to '*20 pt*'. This allows us to create more 'wavy' shape of sectors and make radial background more 'spiral-like'.



Below are the illustrations of sector shapes of original background created form template (left), after **Amplitude** attribute modification (right):



◆ **Example 2:** '**example 2.exc**' file contains further modification of '**example 1.exc**' background. This time **Frequency Modulation** effect is added to border paths with following attributes in **FX** panel of **Excentro Control**:

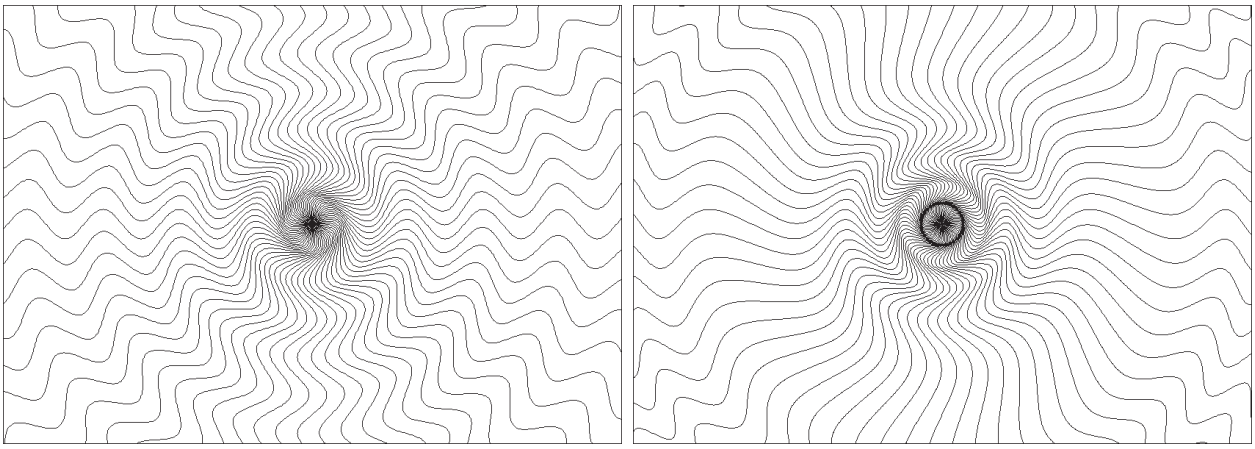
◆ **Frequency Modulation** checkbox — '*On*' (switch **on** this checkbox to activate **Frequency Modulation** effect and other fields of this group)

◆ **Periods** ='*1*' (this will create single area of higher/lower **Frequency** in every copy of the path)

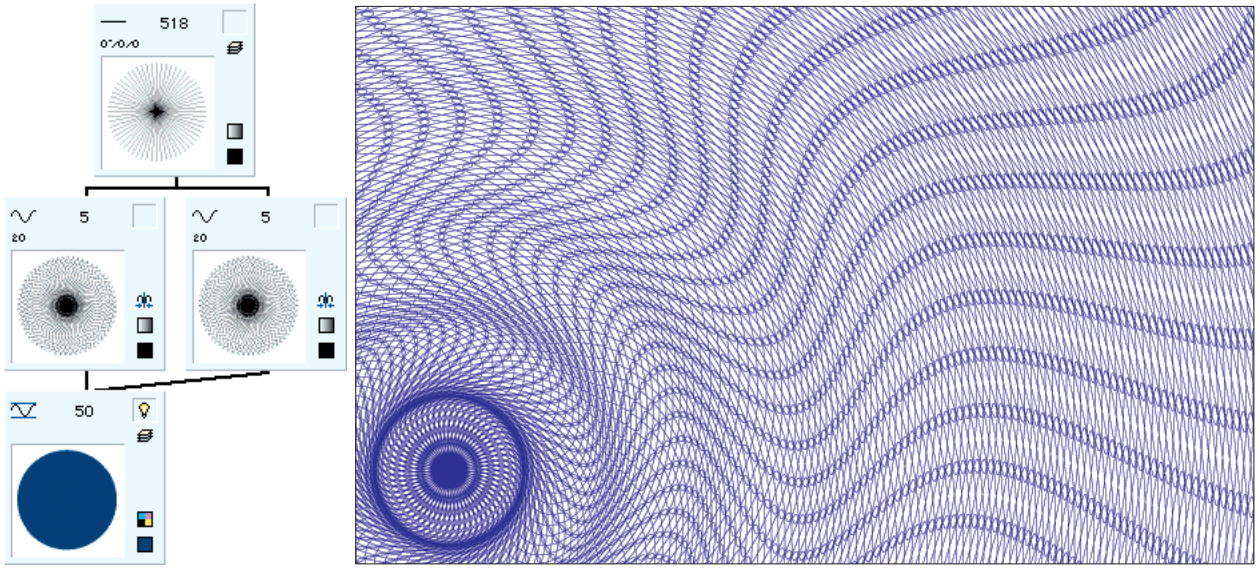
◆ **Phase** ='*0°*' (default initial value: first area of higher **Frequency** starts at the beginning of the path)

◆ **Amount** ='*3*' (in area of higher **Frequency**, **Frequency** attribute reaches value '*8*': *5 + 3 = 8*, in area of lower **Frequency**, **Frequency** attribute reaches value '*2*': *5 – 3 = 2*)

Frequency Modulation effect modifies shapes of sector borders of radial background so, that they become less periodic as shown on following picture (left picture shows sectors of '**example 1.exc**', right picture — '**example 2.exc**'):

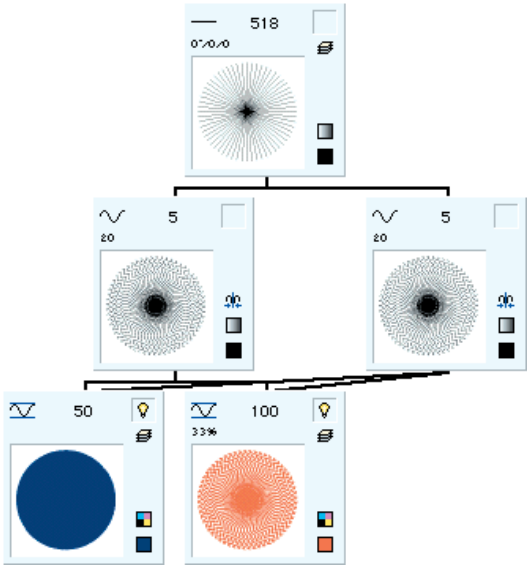


Number of paths of Step & Repeat Set of background content element is increased in this example from 3 to 4 and **Rotation** attribute of the second border regular element is changed to '*7.5°*' from initial value of '*6.2°*'. This change allows us to make paths of content element from adjacent sectors intersect each other and create more dense radial background pattern.

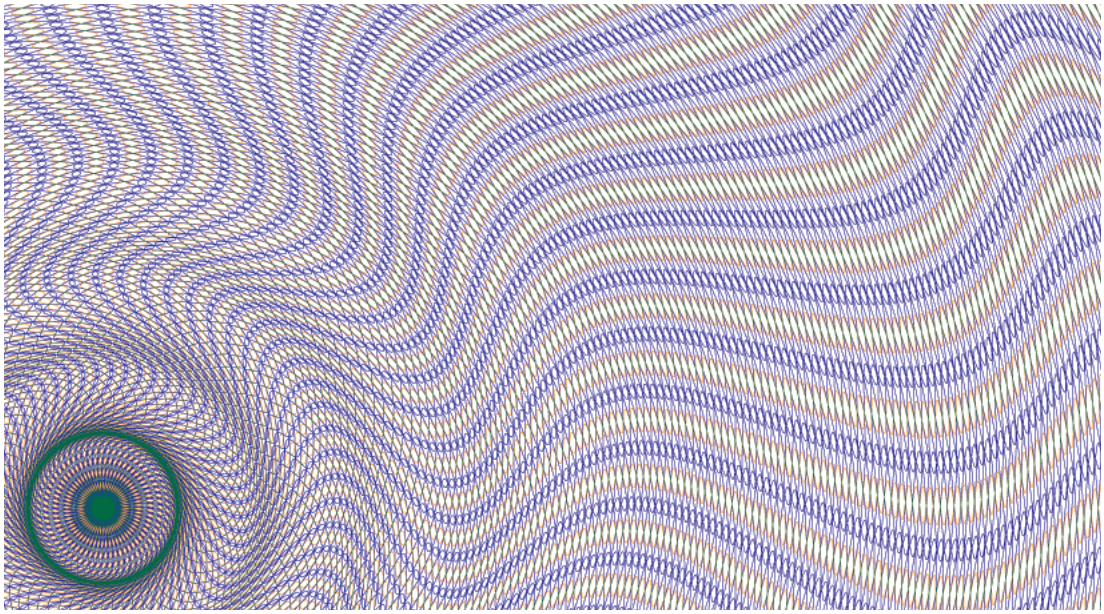


◆ **Example 3:** '**example 3.exc**' file is similar to '**example 2.exc**'. This time we added one more content element between border paths of the sector. This element has attributes: **Frequency** = '*100*', **First Base Offset** and **Second Base Offset** are set to '*33%*'. With these non-zero base offset attributes paths of new content element occupy 34% (or 1/3) of sector's width. New element's path has orange color.

Number of paths value of new element's Step & Repeat Set is set to '*2*'. As you may note, this element has twice the **Frequency** of the first content element, so, to preserve backgrounds paths density we should reduce number of paths in its Step & Repeat Set proportionally. Paths of new content element intersect with existing paths of the first content element and produce more complicated and interesting pattern.



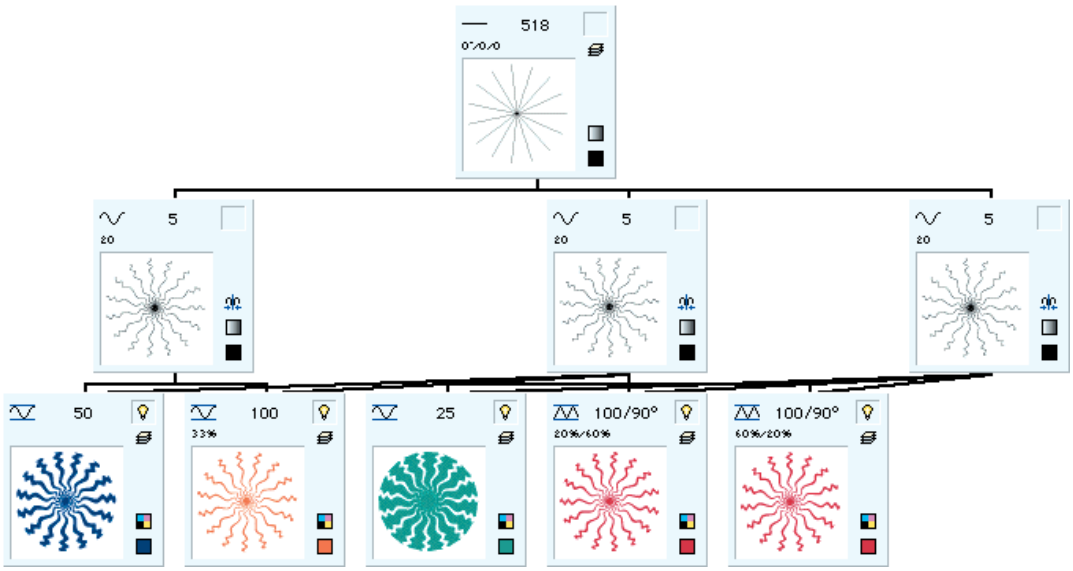
The following picture shows top right part of finished background:



◆ **Example 4:** In '**example 4.exc**' file we reduced number of sectors our background consists of from 60 to 15. But at the same time we made single sector shape more complex.

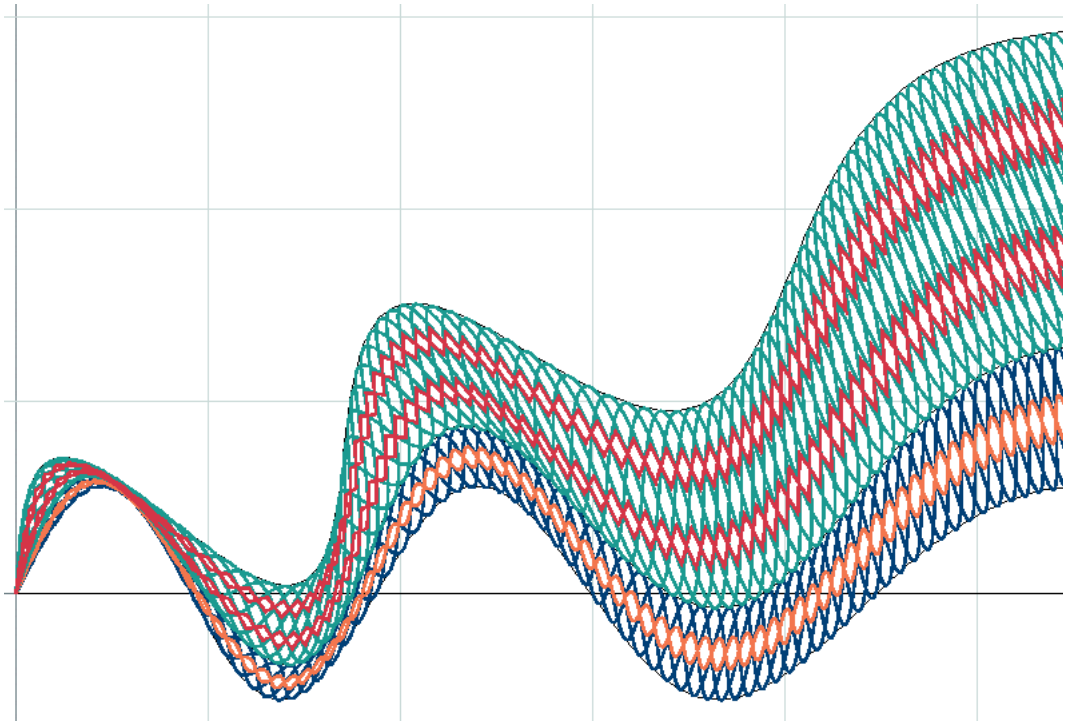
Now the sector consists of two parts and is formed by three wavy regular elements. The first two regular elements and content elements between them are exactly the

same as in previous example. The third regular element has **Rotation** attribute set to '*24°*' (so, 15 sectors form full circle without white space between adjacent sectors). Between the second and the third regular elements we added three more content elements: one **Sine Wave** element with green paths and two **Star** elements with red paths. Paths of these content elements intersect and add new two colors pattern to the background.

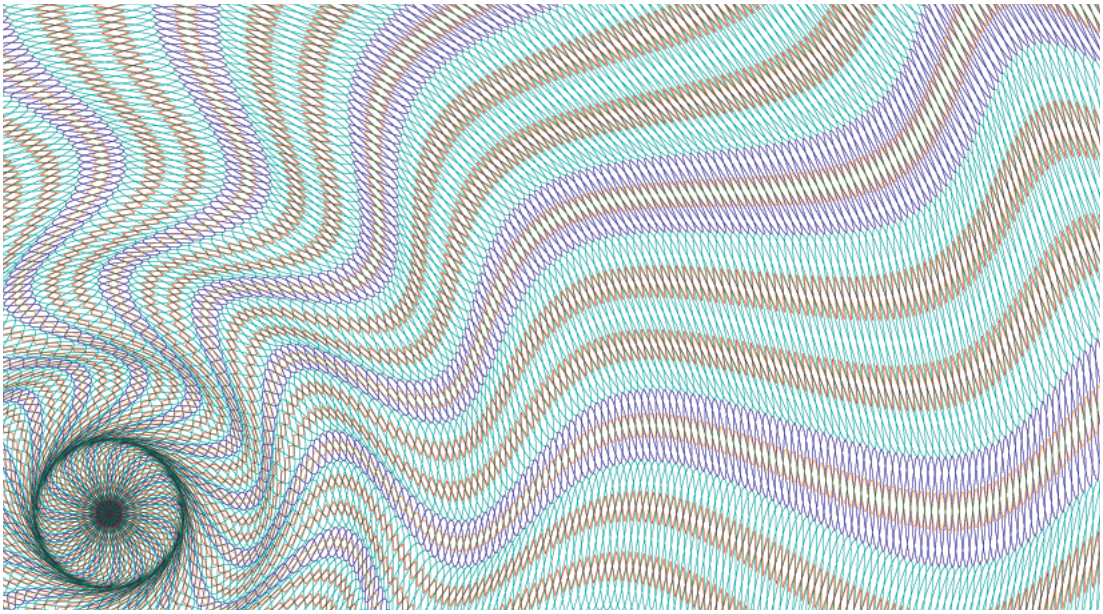


Frequency attributes of new content elements and **Base Offset** values of two **Star** elements are chosen so, that the red paths overlay but not cover completely the openings in the middle parts of the pattern formed by green **Sine Wave** content element.

Below is the picture of a single sector of '**example 4.exc**' background:



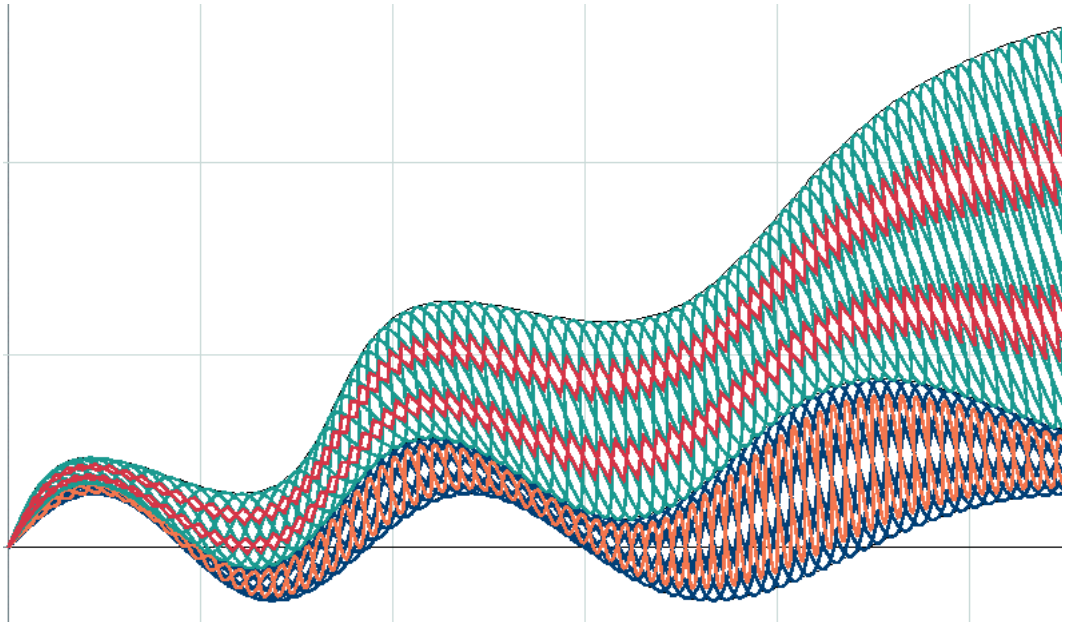
Top right part of the finished background (see picture on the following page):



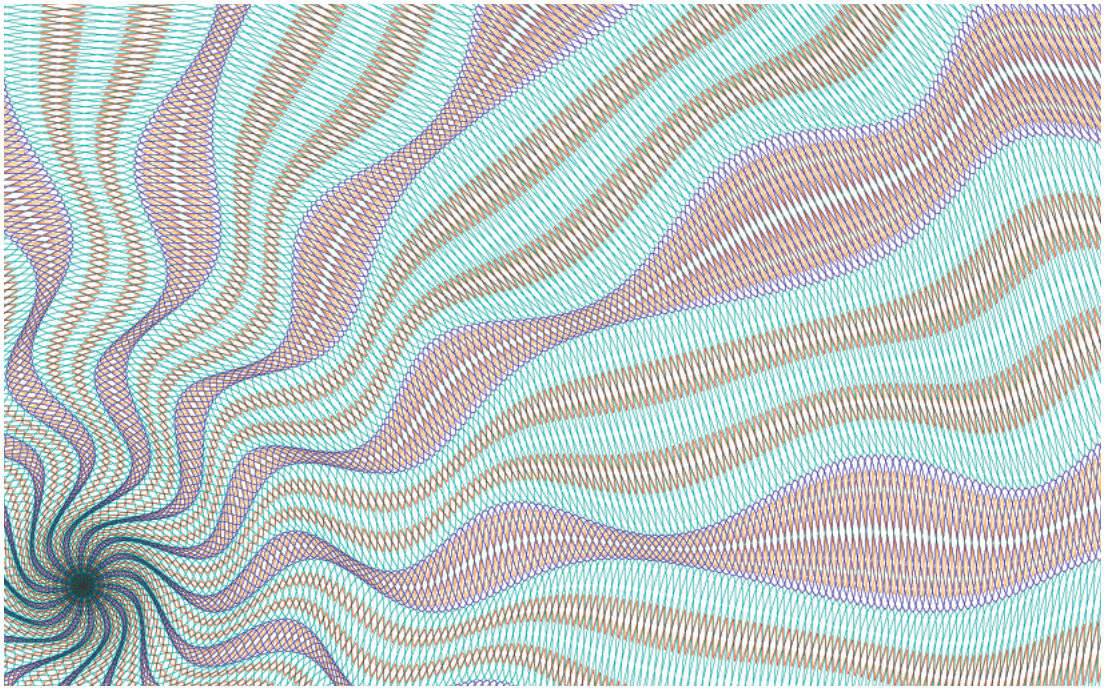
◆ **Example 5:** Background of '**example 5.exc**' file has same 15 wide sectors of 24° as '**example 4.exc**', but this time the regular element that divides a single sector in two parts has different shape comparing to that of the border regular elements.

All regular elements of this background have **Amplitude** attribute value reduced from '*20 pt*' to '*10 pt*'. Attributes of the regular element that divides sector in two parts are changed to: **Frequency** = '*6*', **Amount** of **Frequency Modulation** = '*2.5*'. As a result the paths of the background have smoother shape with variable amplitude. Base offset values of orange content element are modified so, that its paths produce a wider pattern.

Below is the picture of a single sector of '**example 5.exc**' background:



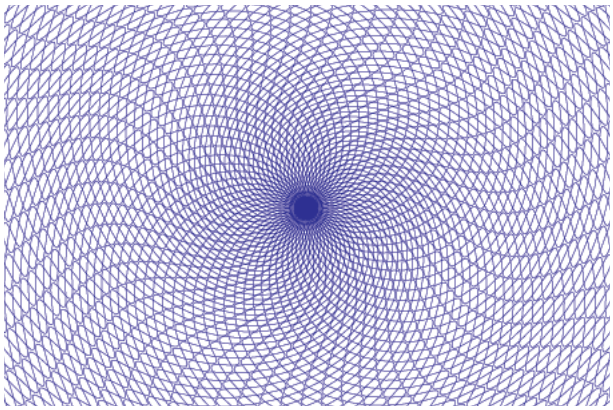
Top right part of the finished background:

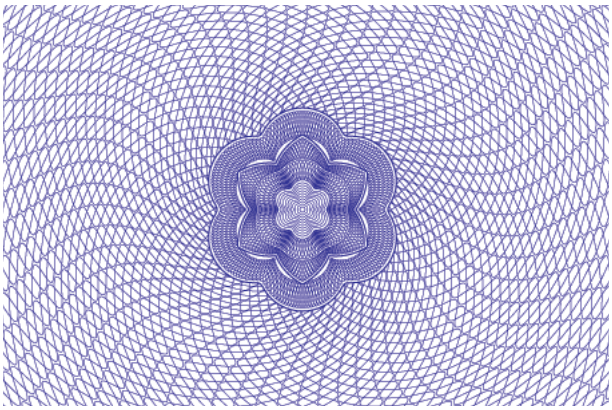


CENTRAL PROBLEM

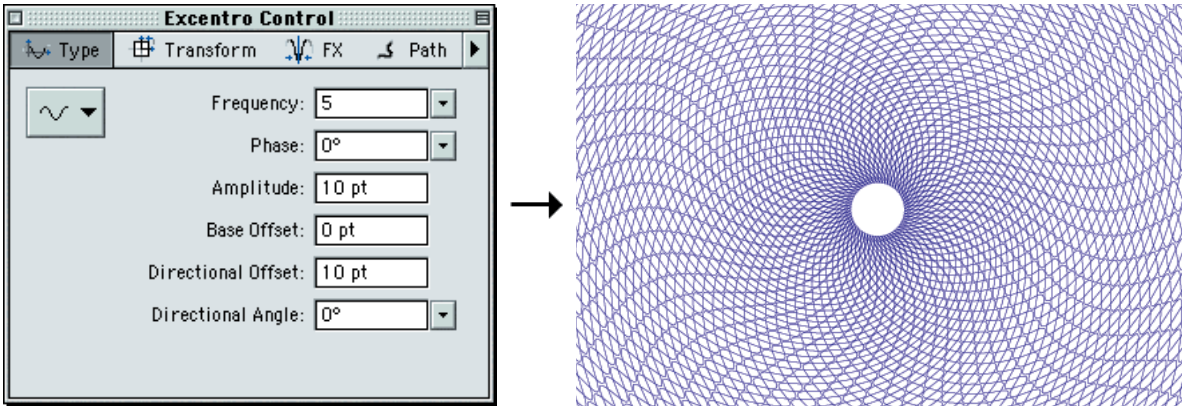
You may note, looking at the examples above, that there might appear certain problems with radial backgrounds when density of paths in the center of the design becomes to high. This can result in difficulties or even defects at print time: if stroke weight is wide enough neighbor paths can merge together or even form single ink filled area in the center. In this section we will show you several ways to cope with this situation.

1. Hidden Center: The simplest solution to the problem would be to hide the problematic area altogether. Just cover it with rosette or text box with your diploma/certificate title. Left picture below shows our radial background created from the template, right picture shows the same background with the center covered by simple rosette design (see '**example 6.exc**' file):

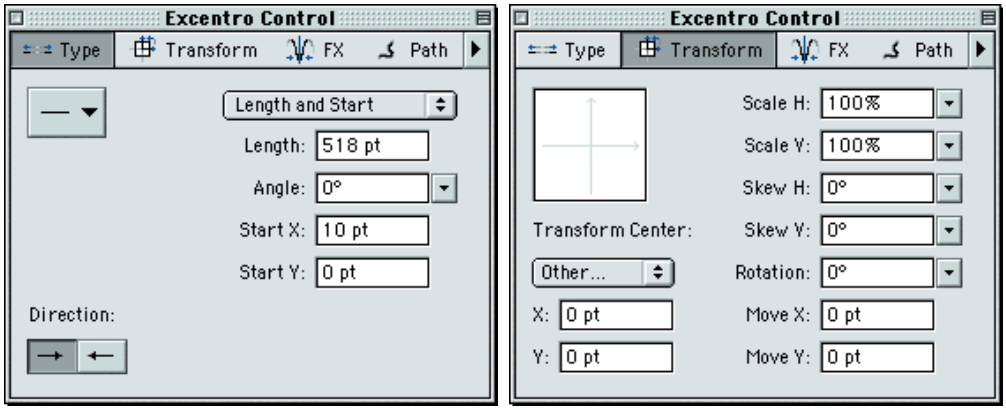




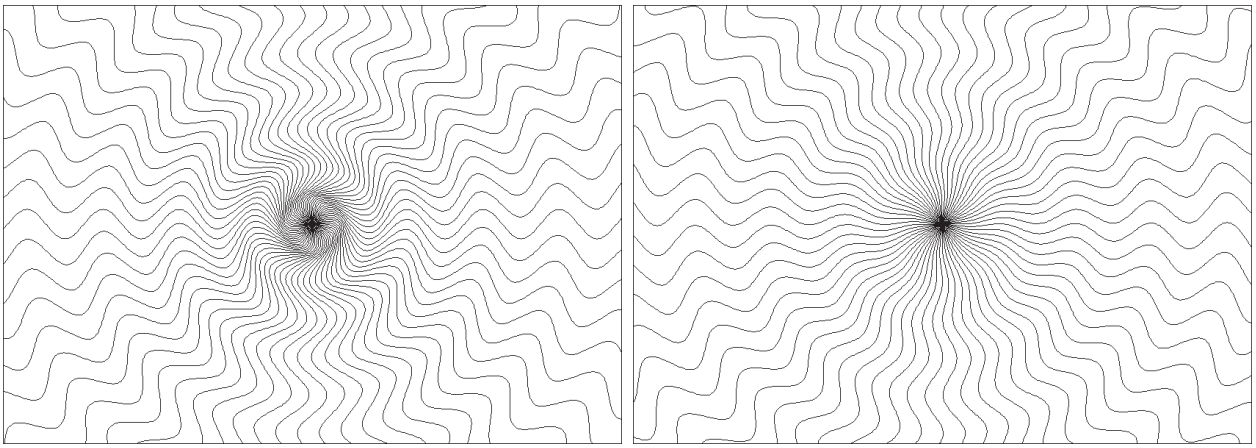
Before the center of the background is covered you can also clear it from unwanted paths. '**example 7.exc**' file shows how to do it by modifying **Directional Offset** attribute of border regular elements. Just set this attribute to some positive value, for example '*10 pt*' to free radius of this size from paths:



'**example 8.exc**' file shows how you can achieve the same result by modifying the value of **Start X** attribute for **Line** base object to '*10 pt*'. You should also set **Transform Center** attributes (in **Transform** panel of **Excentro Control** inspector) for all elements to point [0 pt, 0 pt]:

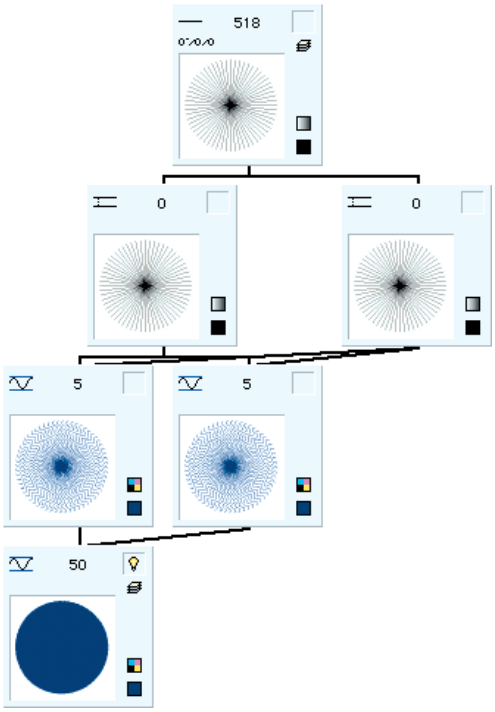


2. Variable Amplitude: The reason why density of paths in the center of the radial background becomes too high is not too difficult to discover: **Amplitude** of border regular elements is fixed and is uniform along whole length of the paths. As a result in the center of the background these paths are too close to each other or even can overlap if **Amplitude** of waves is too high. We can try to solve this problem by creating border paths with variable **Amplitude**. Compare two following pictures:

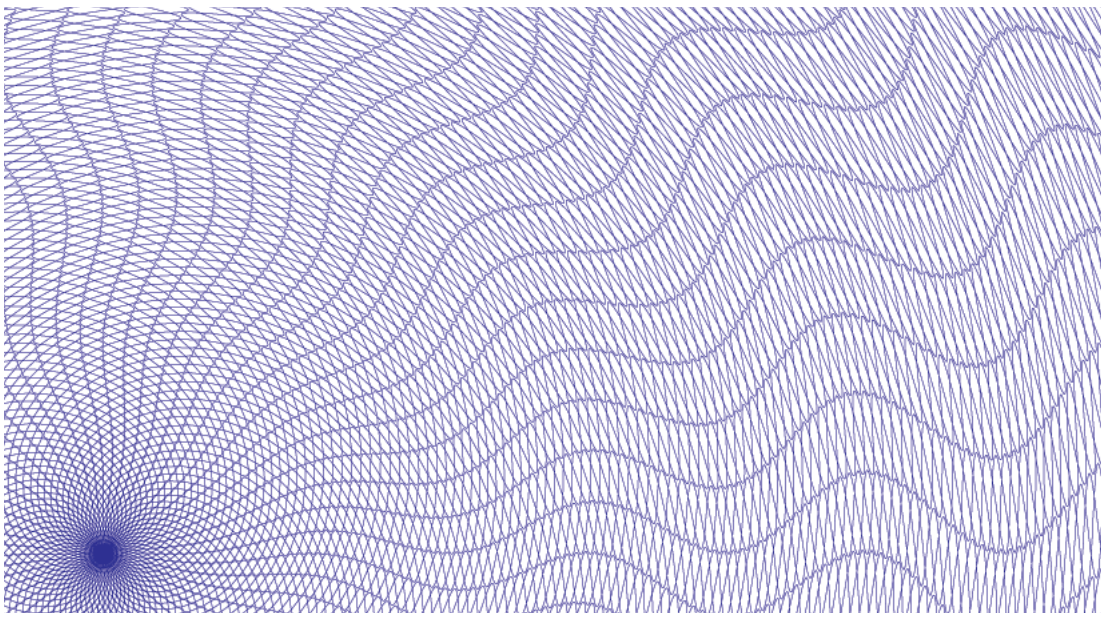


Left picture shows border paths of radial background of '**example 1.exc**' file, right picture shows border paths of '**example 9.exc**' file. As you can see **Amplitude** attribute of first picture is fixed at '*20 pt*' value, **Amplitude** of right picture is variable and changes along the paths length.

To create border paths with variable **Amplitude** we should use content elements of **Sine Wave** type in place of the regular elements. Let us add two new **Offset** regular elements to **Line** base object that form 6° angle sector. Between these paths we should create content element of **Sine Wave** type. **Amplitude** of this **Sine Wave** is variable and changes from 0 to maximum value formed by endpoints of 6° angle radii. Just like before, we will create a copy of this **Sine Wave** path rotated by 6.3° around its starting point and add content element between these wavy sector borders that produce background paths.



The following picture shows top right part of '**example 9.exc**' background. Paths density in the center of the background was reduced, while shape of sectors in document corner and border areas remained close to that of '**example 1.exc**':

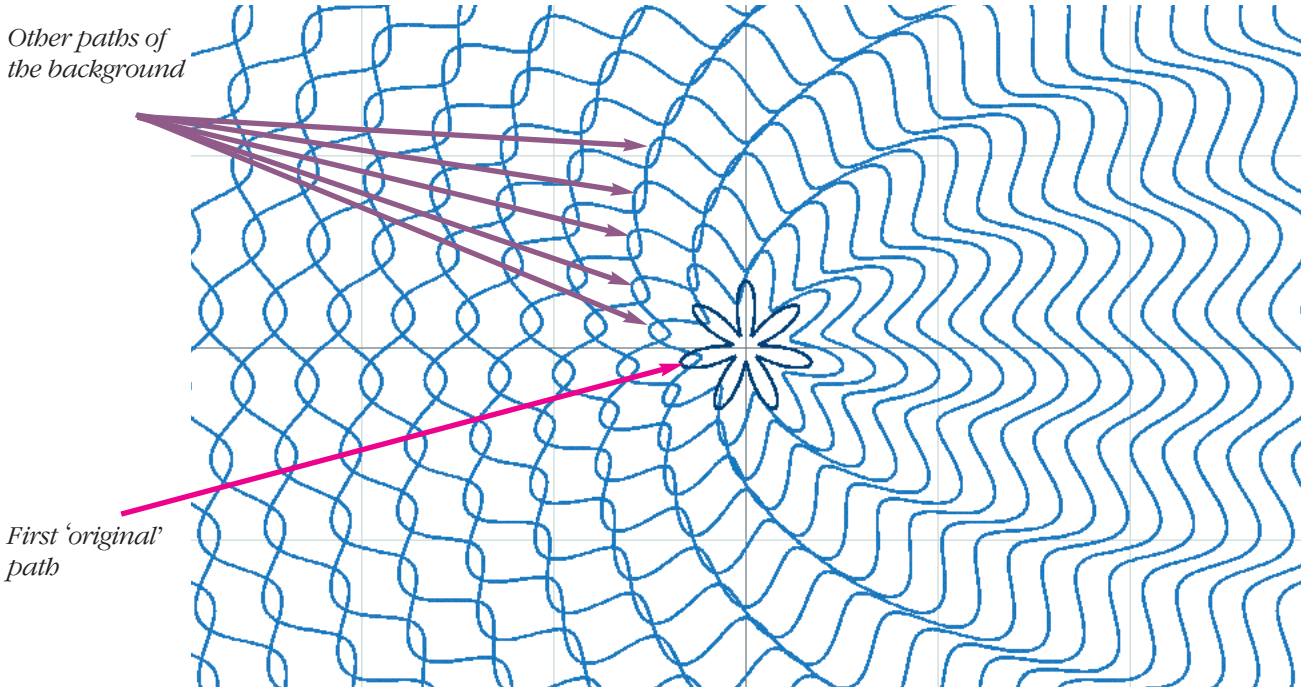


CHAPTER 5: CIRCULAR BACKGROUNDS

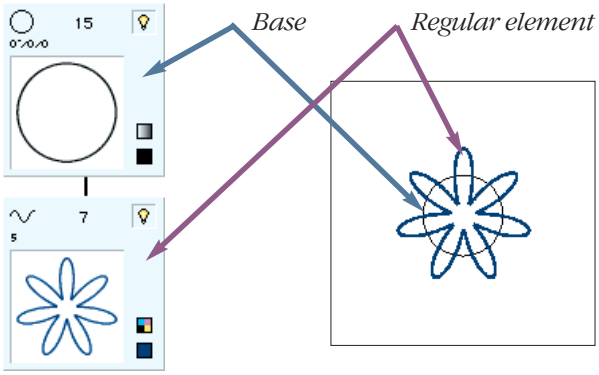
This chapter explains how to create concentric circular backgrounds using only two *Excentro* objects and one Step & Repeat Set. Example we will construct in this chapter is the same as that of stationary file '**Background Template 4.exc**' from '**Excentro Templates**' folder. You can use this template to create new circular backgrounds by modifying attributes of its objects without a need to reconstruct them in new file following all steps described below.

CASE STUDY

Circular backgrounds represent a set of wavy paths positioned on concentric circles with expanding radii. To make the background pattern more interesting and difficult to counterfeit each wavy path in this set has shape slightly different from others. Paths of the circular background are not exact copies of the first original path (as, for example, it was in case of linear backgrounds). Following picture shows the typical circular background:

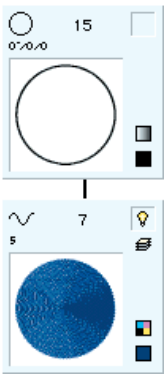


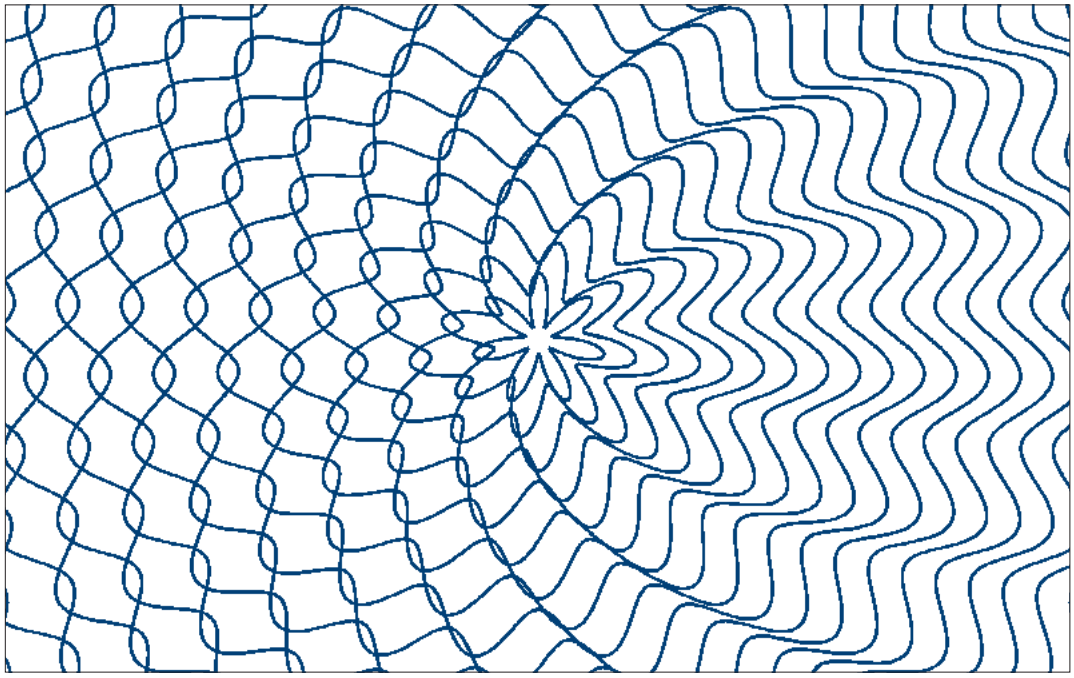
Since the background is 'circular' we should start with base object of **Ellipse** type as the root object for the guilloche design. Size of this base circle should not be very large because it will be used as a base path for the first wavy path with 'smallest radius' in the center of the background. Guilloche structure with single **Ellipse** base object and one path of **Sine Wave** regular element is shown below:



To create other paths of the background we will use Step & Repeat Set modification of **Sine Wave** regular element. We could apply Step & Repeat Set to **Ellipse** base object to increase size of circular base paths, but this technique will limit our ability to modify shapes of wavy background paths and the design will be less interesting.

Step & Repeat Set applied to **Sine Wave** regular element should modify at least **Base Offset** attribute to make wavy paths expand and reach document borders. It also is a good idea to modify **Frequency** attribute of **Sine Wave** to increase number of waves each following wavy path has. As the last step we should switch off visibility of **Ellipse** base path and our circular background is ready.

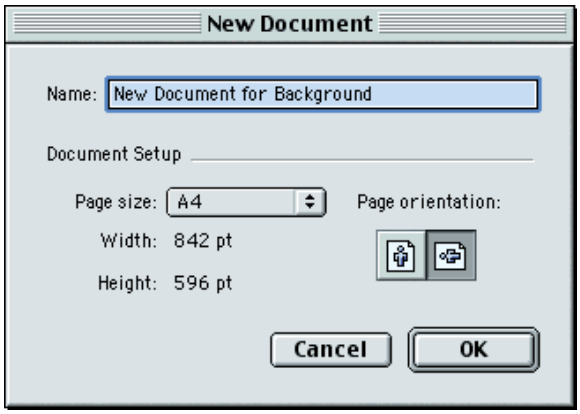




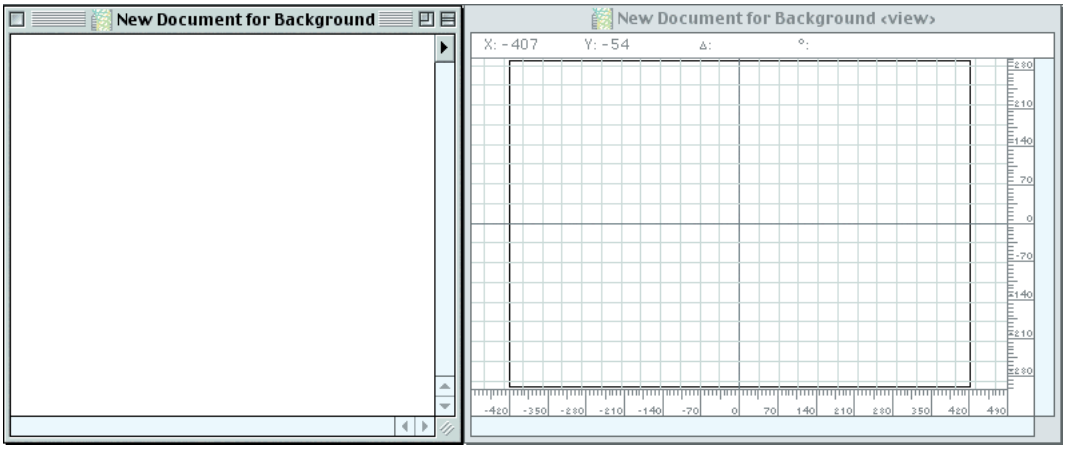
STEP BY STEP BACKGROUND CREATION

Below we provide detailed description of all steps required to create this background.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Select proper predefined document size from pop-up menu or enter custom document dimensions. To simplify work and graphics preview new document should have the same size as the background you want to create. In this example we will create background of '*A4*' size with '*Landscape*' orientation that could be used for standard diploma or certificate.



Click **OK** button and two windows of new document will appear in front of you:



■ **Step 2: Ellipse Base Object.** As the root object for our circular background design we will use base object of **Ellipse** type. We will make path of this object 'circular' with equal values of **Width** and **Height** attributes. This circle will be positioned in the center of the document.

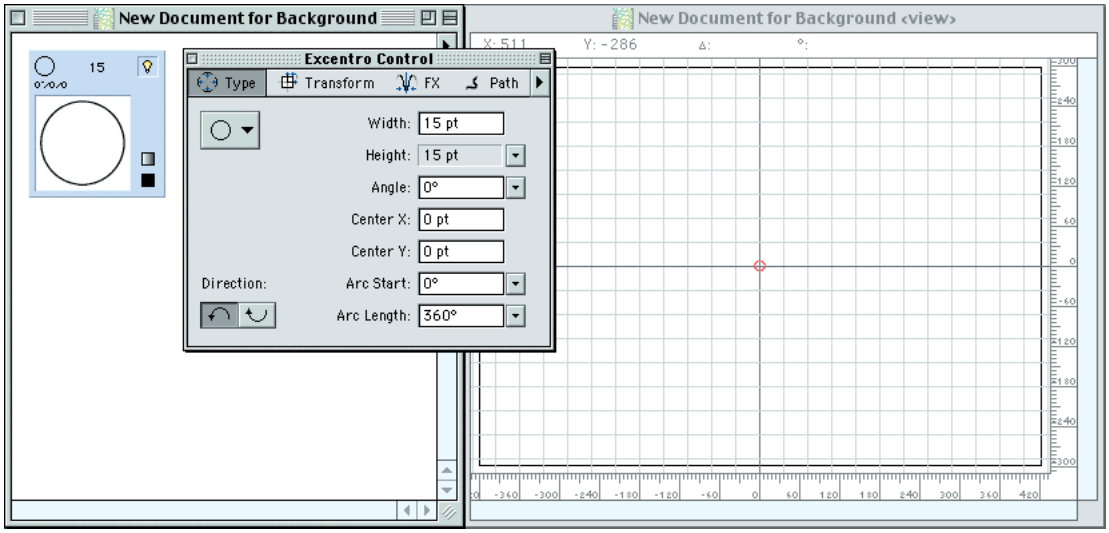
Choose **New Base** command from **Structure** menu to create new base object. After that in **Excentro Control** inspector choose following options:

- '*Ellipse*' from **Type** pop-up menu

Enter following attributes in appropriate fields of **Excentro Control** inspector:

- **Width** = '*15 pt*' (size of the circle should not be very large because it will be used as a base path for the first background path with smallest radius)
- **Height** = '*15 pt*' (this value is automatically set up if **Same as Width** option is chosen from pop-up menu beside this field)
- **Angle** = '*0°*' (default initial value)
- **Center X** = '*0 pt*' (horizontal center position in the document)
- **Center Y** = '*0 pt*' (vertical center position in the document)
- **Arc Start** = '*0°*' (default initial value)
- **Arc Length** = '*360°*' (default initial value that corresponds to full circle arc)

Base creation is finished, you should get following picture on your screen (preview of base circle is shown with red in document preview window because it is a selected object):



■ **Step 3: Sine Wave Regular Element.** Let us create the regular element that will produce all wavy paths of our background. The first background path will be original path of the element itself, rest of the background paths will be produced by its Step & Repeat Set modification.

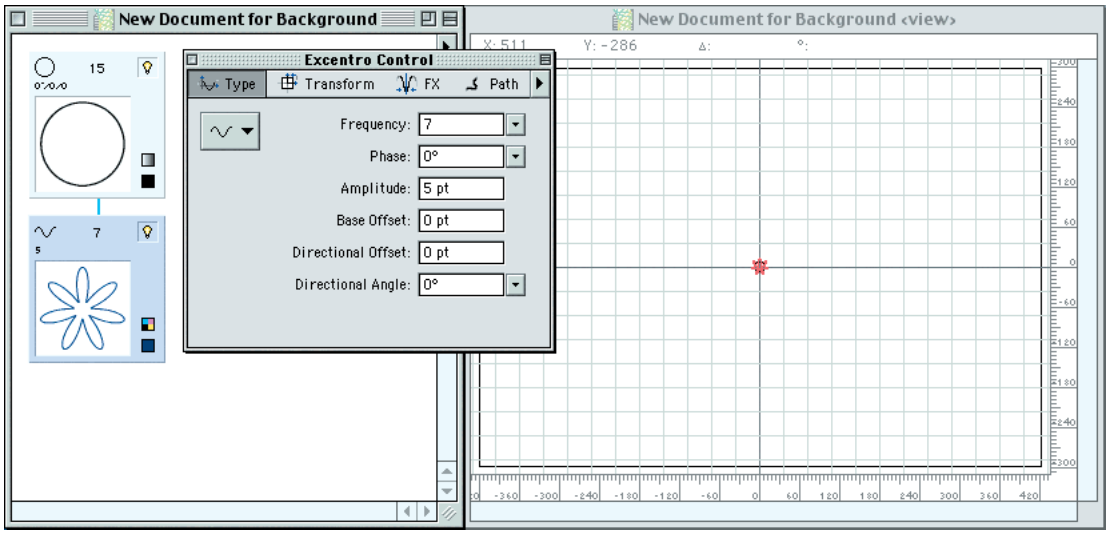
Select the base object we created in step above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

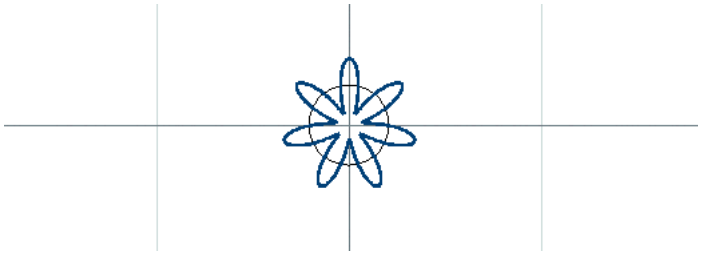
- **Frequency** = '*7*' (the first background path should not have too many waves)
- **Phase** = '*0°*' (default initial value, no need to change it)
- **Amplitude** = '*5 pt*' (background paths should not be 'too high')
- **Base Offset** = '*0 pt*' (default initial value)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

Sine Wave regular element is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):

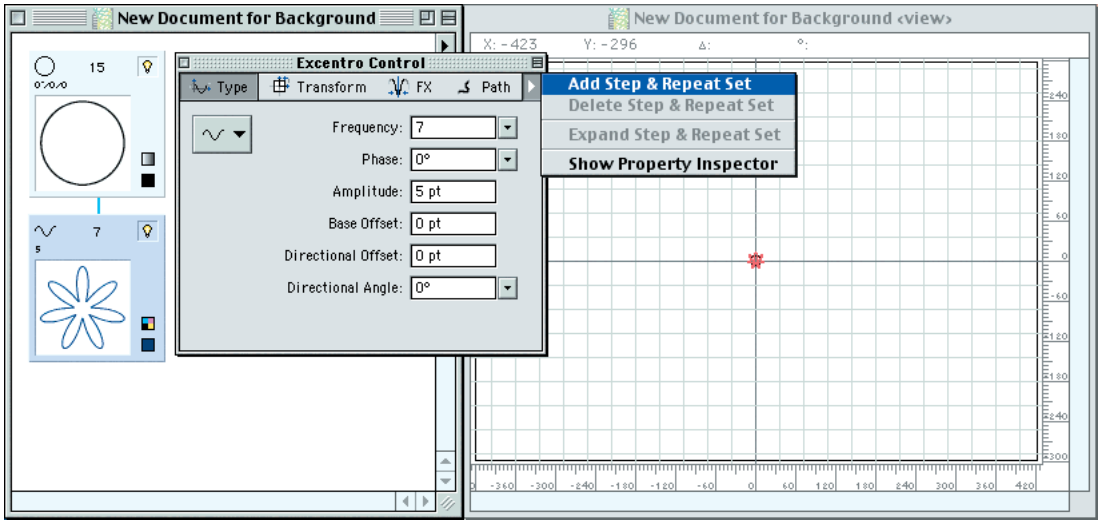


Let us apply stroke and color attributes to the background path: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points (we want background paths to become visible, but not too thick, so other graphics and text placed above this background will remain readable). Mix appropriate color in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control** (for example, let it be some blue color).

You can zoom to area occupied by new path in preview document window to check its shape and color at higher magnification value:



■ **Step 4: Step & Repeat Set.** The first path of our background was already created in previous step: it is the original path of **Sine Wave** regular element. Now let us apply Step & Repeat Set modification to this element and create other paths of the background. Select the regular element with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu (button with triangle in top right corner of the window).

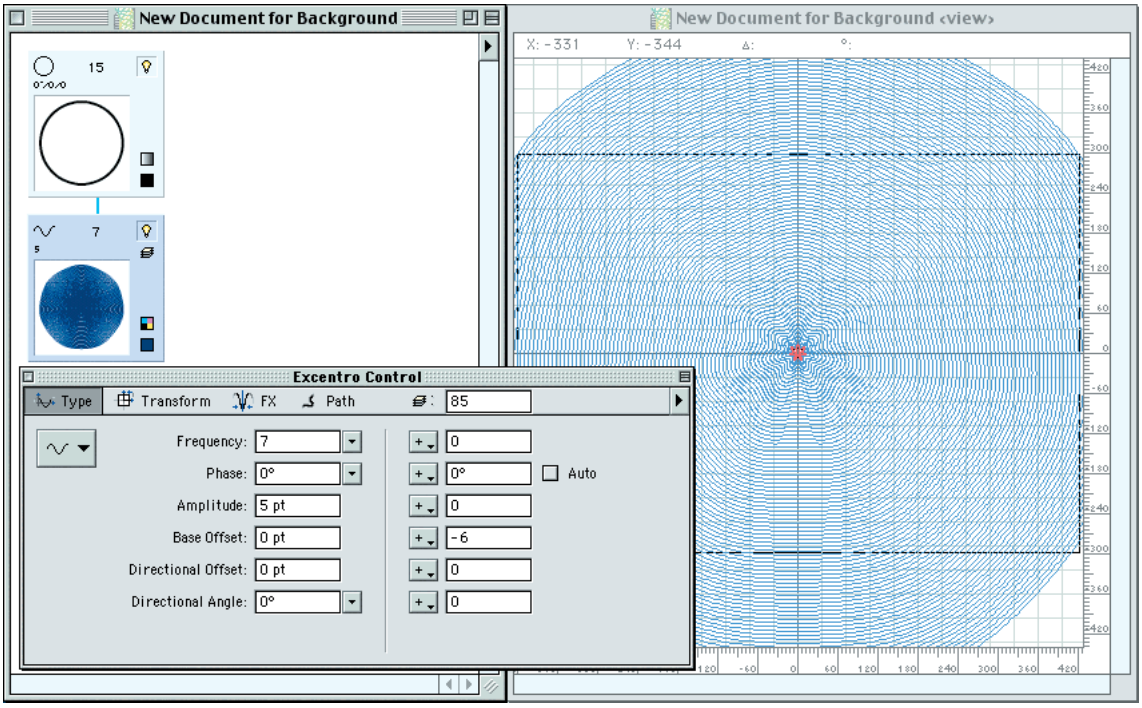


New Step & Repeat Set will be added to the object. Enter following values in Step & Repeat Set fields:

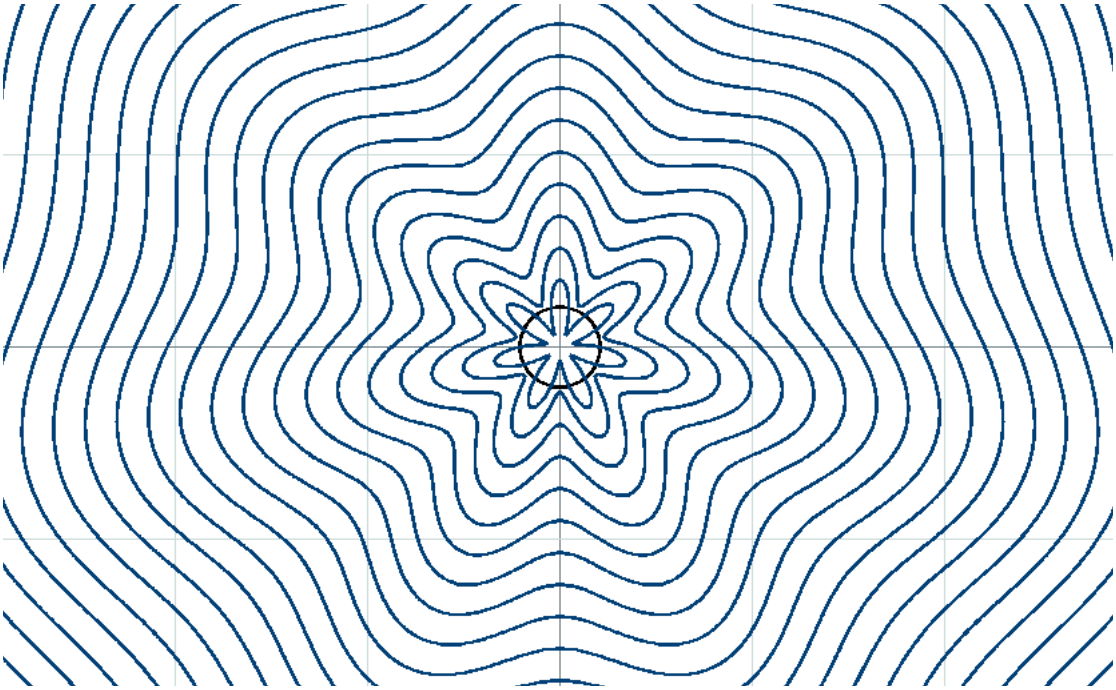
◆ **Number of Steps** = '*85*' (this will make a set of 85 paths: original path of the regular element and 84 additional copies)

◆ **Base Offset** = '*–6*' with **Constant** type of **Increment** (every following path will be offset by another 6 points from original circle radius and the set of 85 paths will cover all our A4 document area)

Let us leave the rest of Step & Repeat Set increment fields at their initial zero values at first. You should get following picture on your screen:



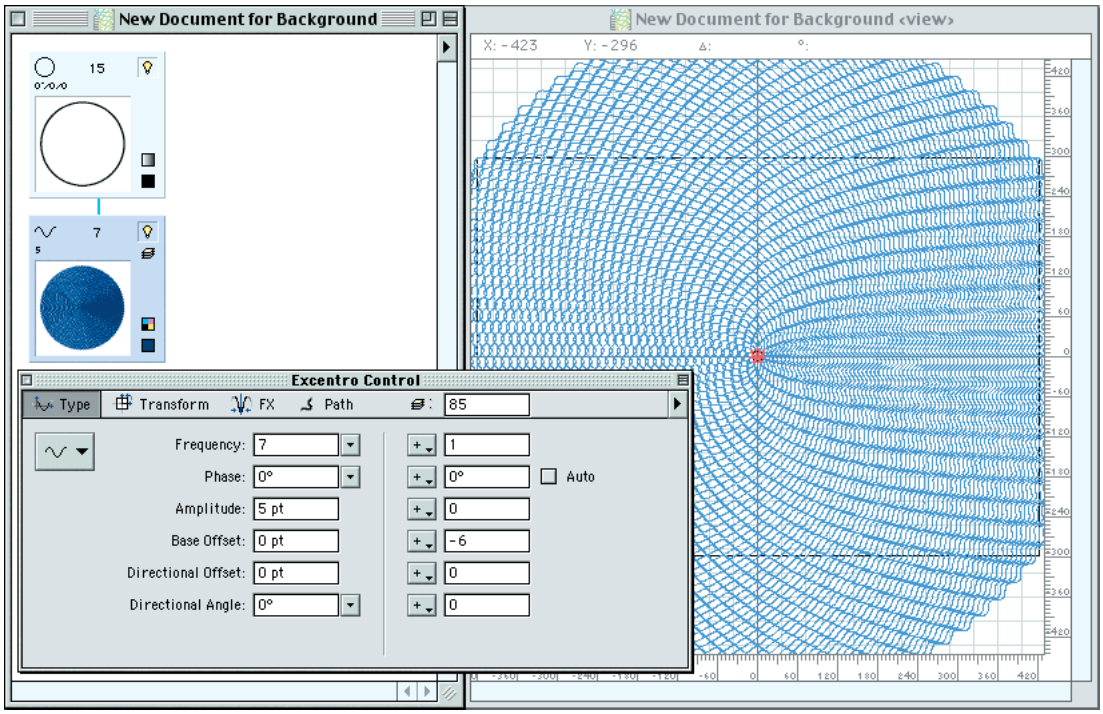
You can zoom to look at new paths in preview document window at higher magnification value:



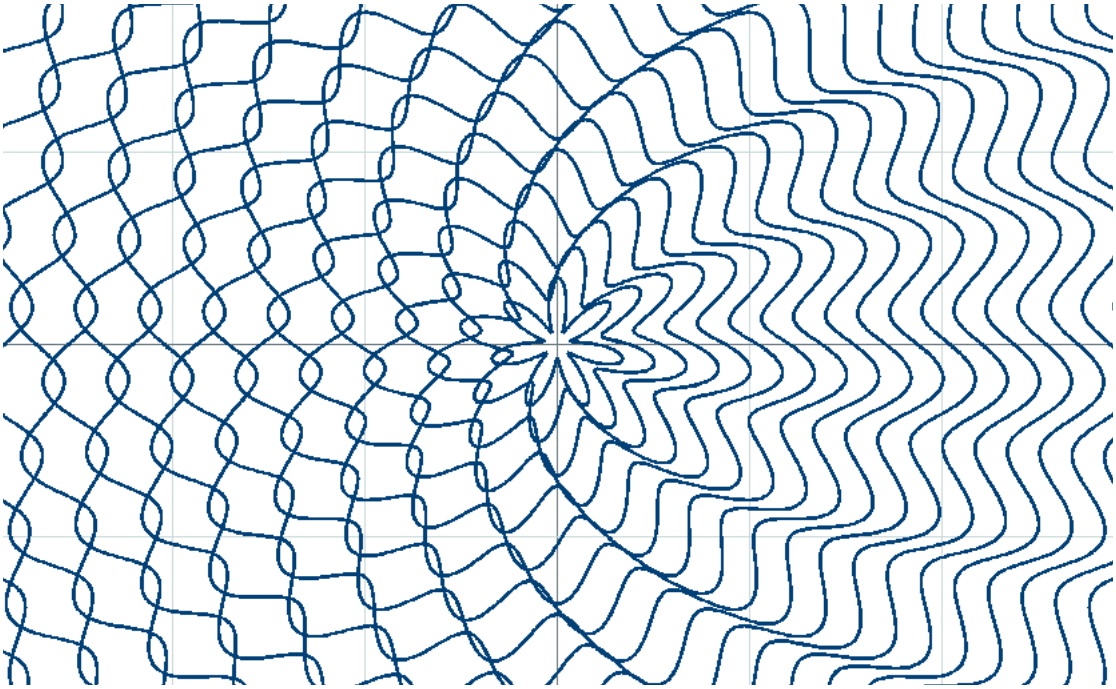
All wavy paths have same **Amplitude** and **Frequency** attribute values, as a result the farther the path is from the center of the document the 'smoother' its shape gets. The paths that are close to the document borders are almost not distinguishable from very wide circles. This is not exactly what we can call 'cool background', so let us add another **Sine Wave** attribute modification to the Step & Repeat Set:

- **Frequency** = '*1*' with **Constant** type of **Increment**

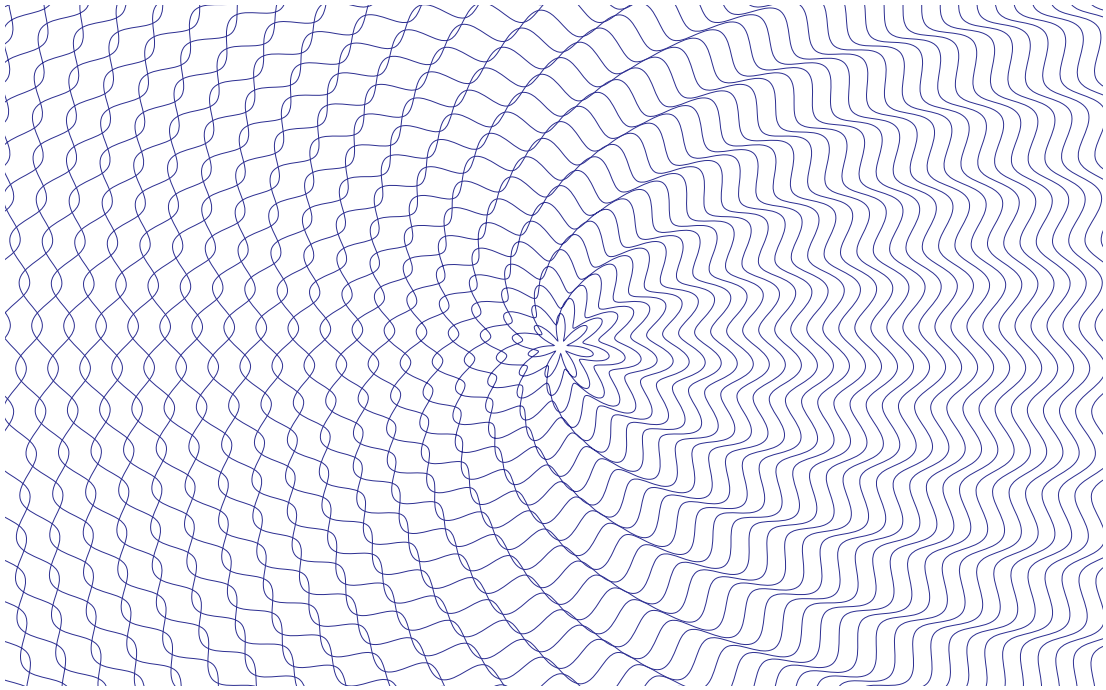
Now every next path will have higher **Frequency** value comparing to its predecessor. **Frequency** of the last path in the set will be equal to 7 + 84 = 91. This new modification produce much more interesting background design with intriguing areas of intersections:



At the very last step , please, switch to **Path** panel of **Excentro Control** inspector and switch off **Visible** check box for **Ellipse** base object to make its path invisible. Final background picture should look exactly like the one shown on the first pages of this chapter.



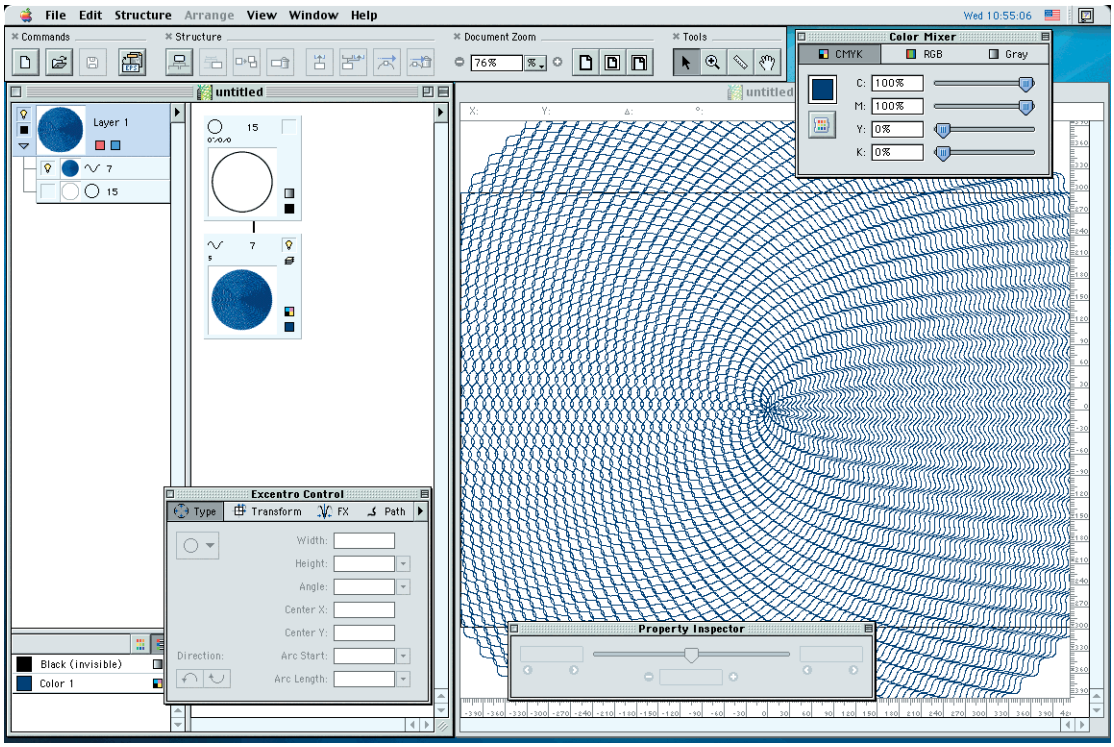
Now you can export this background in *Adobe Illustrator* format using **Export** command from **File** menu and use it as part of certificate, diploma, etc. Parts of the background that protrude outside A4 document area will be clipped off by document's Bounding Box parameter in the exported file. Picture below shows the central part of the background in vector form:



TEMPLATE AND EXAMPLES

Stationary file '**Background Template 4.exc**' from '**Excentro Templates**' folder contains a copy of the document we created in previous section. You can use this template to create new backgrounds by modifying attributes of its objects without a need to reconstruct them in new file as was described above.

■ **Template Usage.** Launch *Excentro* application and open '**Background Template 4.exc**' file. New **untitled** document that contains copy of stationary file content will be opened in front of you:



Save this new document to whatever location on your hard disk you use for guilloche designs giving it meaningful name. Now you can modify objects attributes and create your custom background from this template:

◆ You can change color attribute of the objects. The easiest way to do so is to redefine '*Color 1*' entry in document colors list. Just drag color patch from **Color Mixer** or swatch palette window to color patch (small colored rectangle) of '*Color 1*'. This will automatically change color attributes of objects that use this colors list entry.

◆ You can modify objects attributes. For example: change of object's **Type** will modify its shape making it 'saw-like' or 'tooth-like' instead of wavy; change of object's **Frequency** will add or reduce number of waves or coils its shape has; change of **Side Size** of the **Cycloid** will make its coils smaller or larger, etc.

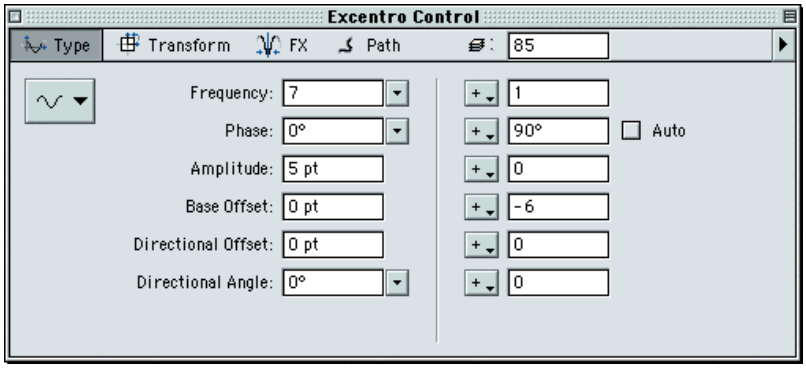
◆ You can add new elements to the background. This will increase number of paths the background consists of making pattern more complex and interesting.

◆ You can modify attributes of Step & Repeat Set changing number paths that form the background or shape of these paths.

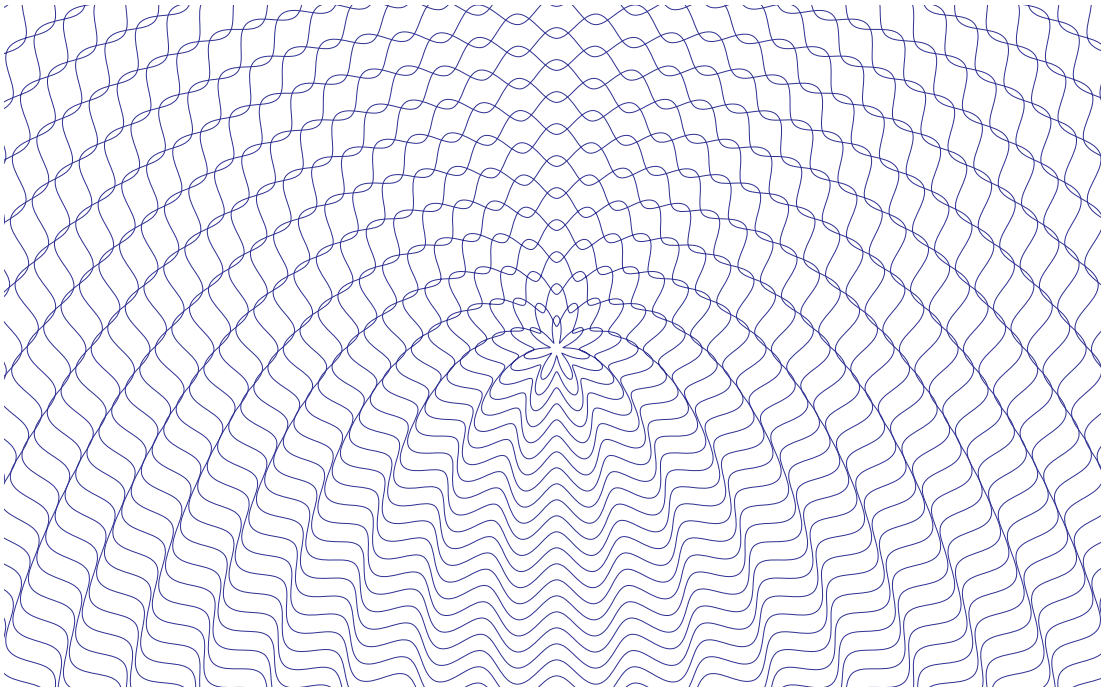
Examples of this template usage are located in '**Background Template 4 examples**' folder. They show most typical variations you can create using '**Background Template 4.exc**' template.

■ **Template Examples.** Let us take a quick look at examples of '**Background Template 4.exc**' variations from '**Background Template 4 examples**' folder.

◆ **Example 1:** The background of our template file has area were neighbor wavy paths intersect each other. This area is located in left part of the design. It is probably would be a better idea to move this area to top or bottom region and restore vertical symmetry of the the design. '**example 1.exc**' file shows how to move intersection area to top part of the background: just add '*90°*' **Phase** attribute modification to Step & Repeat Set of the regular element:

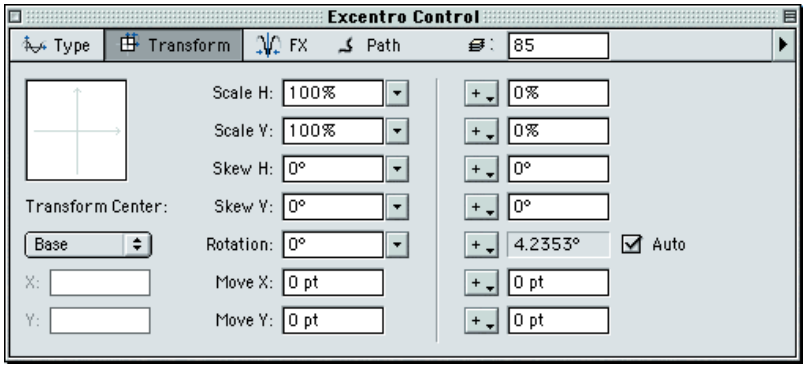


This will modify starting phase of every wavy path in the set, so that intersection area will be moved to the top. Picture below shows central part of finished background in vector form:

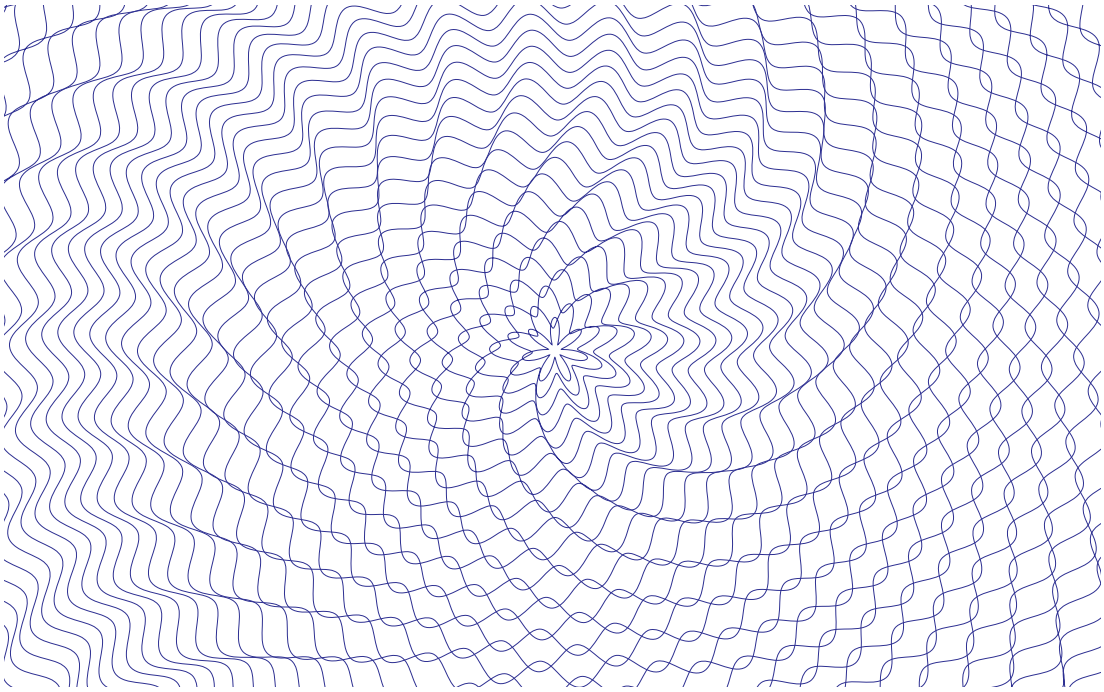


Alternatively, to move paths intersection area to bottom part of the design use '*–90°*' **Phase** attribute modification.

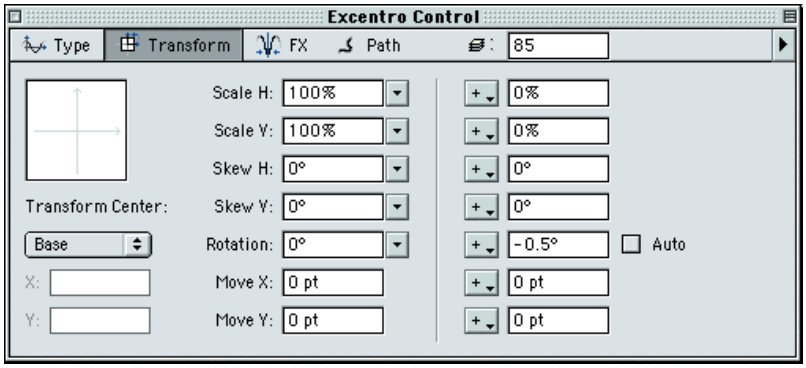
◆ **Example 2:** '**example 2.exc**' adds paths rotation effect to previous example. Switch to **Transform** panel of **Excentro Control** inspector and click **Auto** checkbox beside **Rotation** increment field. Angle value will be automatically calculated so that 85 paths of our background complete full 360° circle around the center of the design:

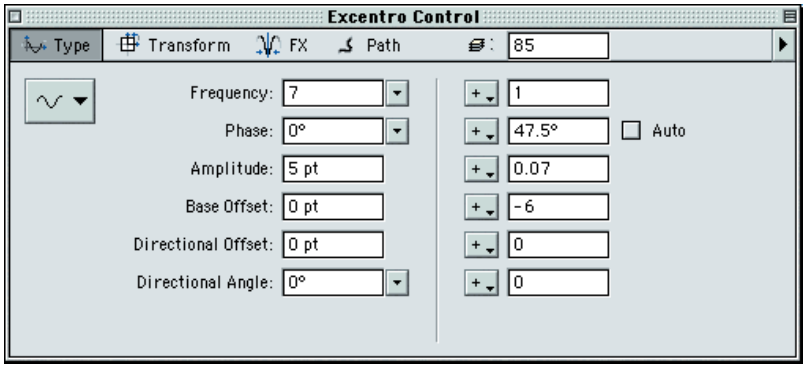


As you can see, this Step & Repeat Set **Rotation** modification turns paths intersections area in counterclockwise direction and adds spiral-like pattern to the background. Picture below shows the central part of finished background in vector form:

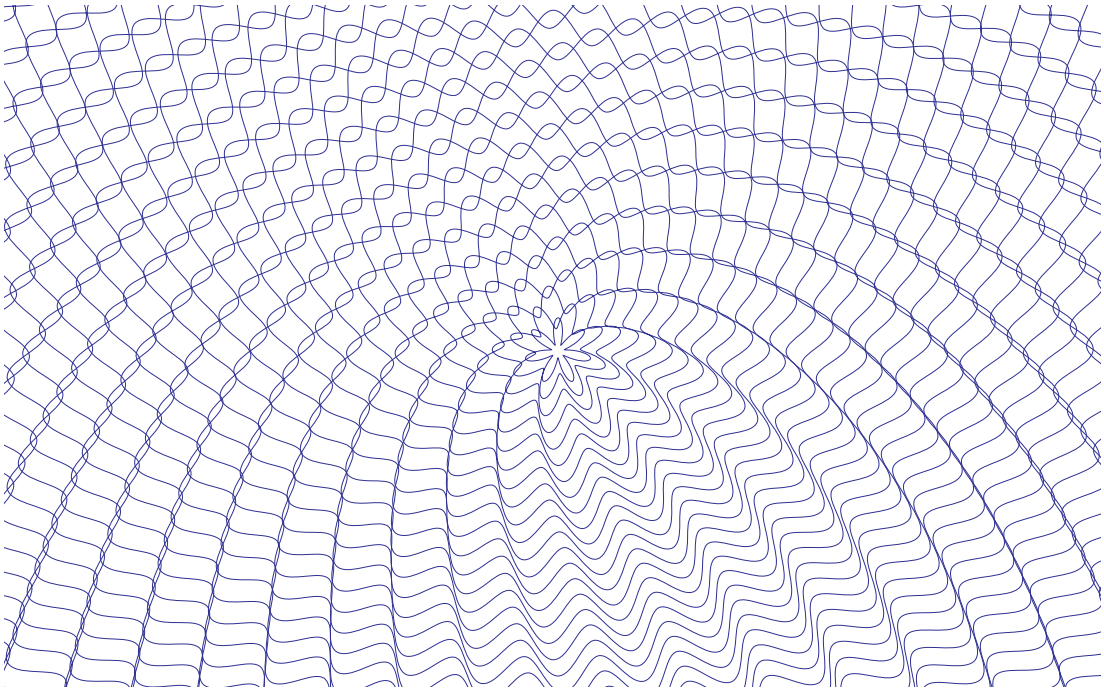


◆ **Example 3:** '**example 3.exc**' is another modification of the Step & Repeat Set attributes from the previous example. This time **Rotation** increment value is reduced to '*–0.5°*', **Phase** increment is set to '*47.5°*' and new modification with '*0.07*' value to **Amplitude** attribute is added:

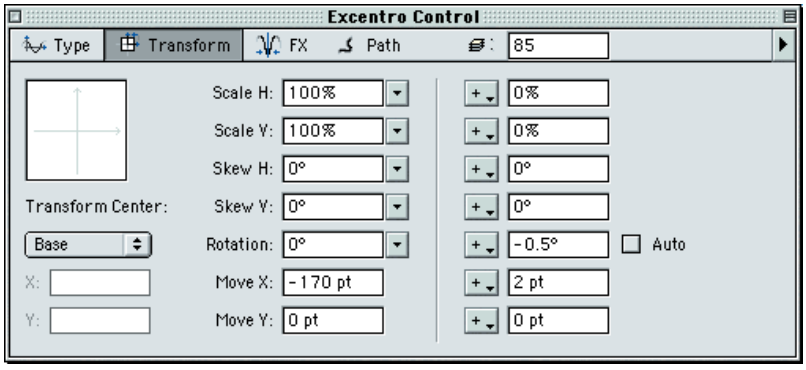




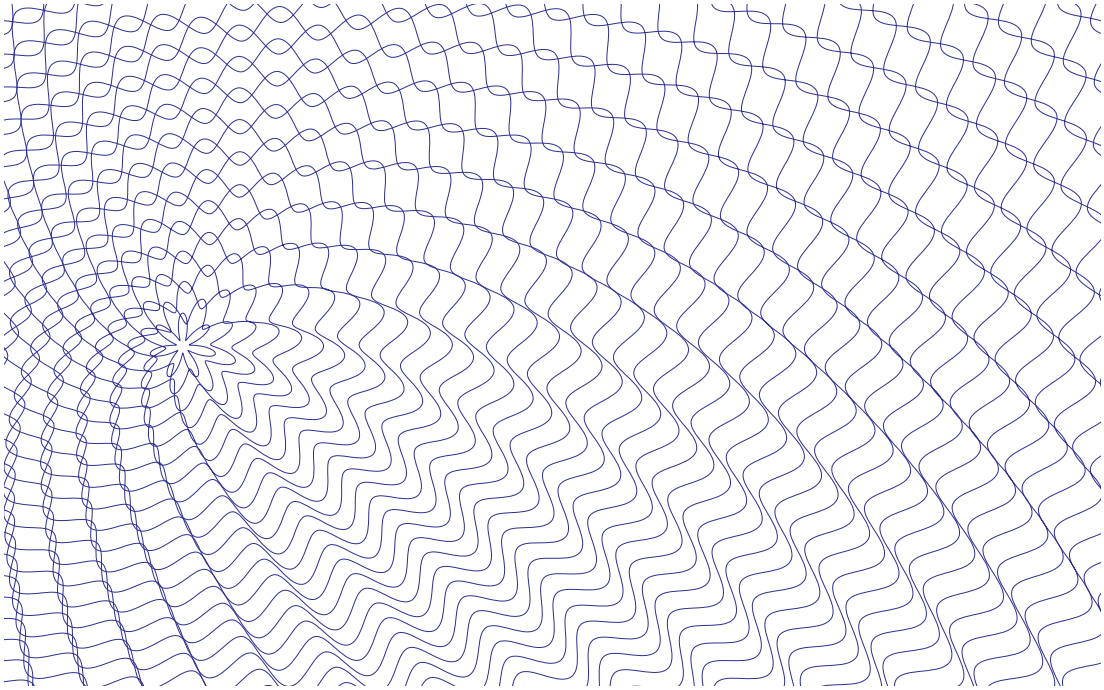
As a result now we have more complicated background than in all previous examples. Each wavy path has larger **Amplitude** attribute. Whole set of paths is rotated to maintain overall vertical symmetry of paths intersection area:



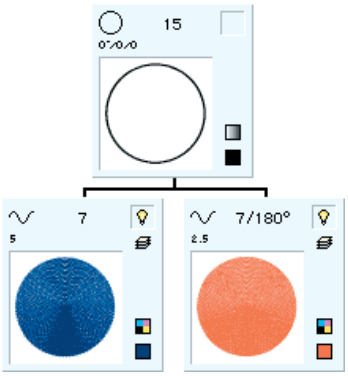
◆ **Example 4:** '**example 4.exc**' is a future modification of '**example 3.exc**' file. It sets **Move X** attribute of **Sine Wave** regular element to '*–170 pt*', so that the center of first wavy path now is located in left part of the background. After that '*2 pt*' increment of Step &Repeat Set gradually offsets other paths of the set so that all document area is filled with background paths:

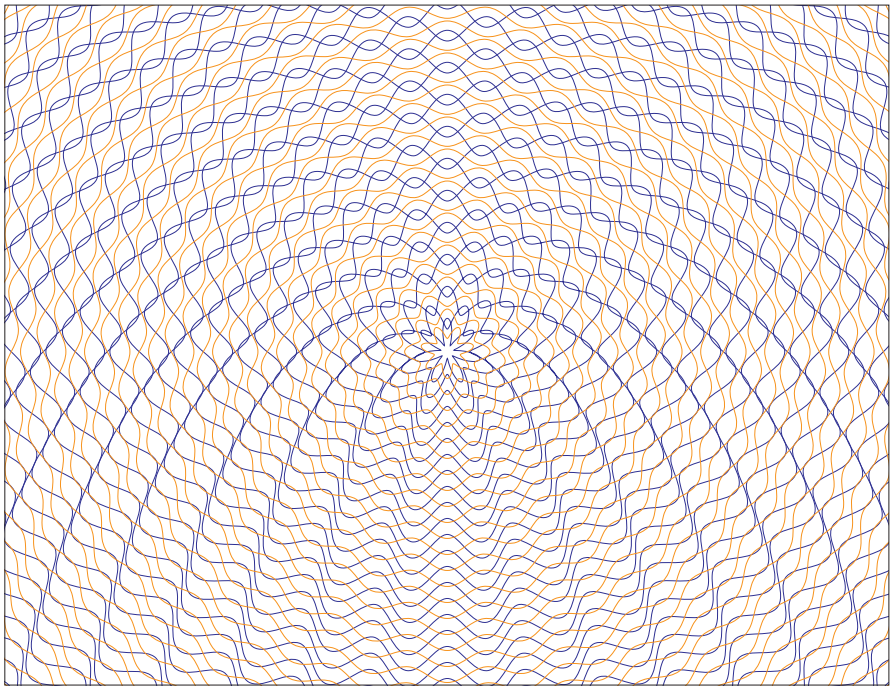


This makes even more complicated and difficult to imitate asymmetric background pattern. Picture below shows the central part of finished background in vector form:

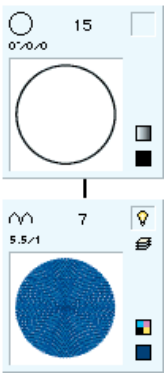


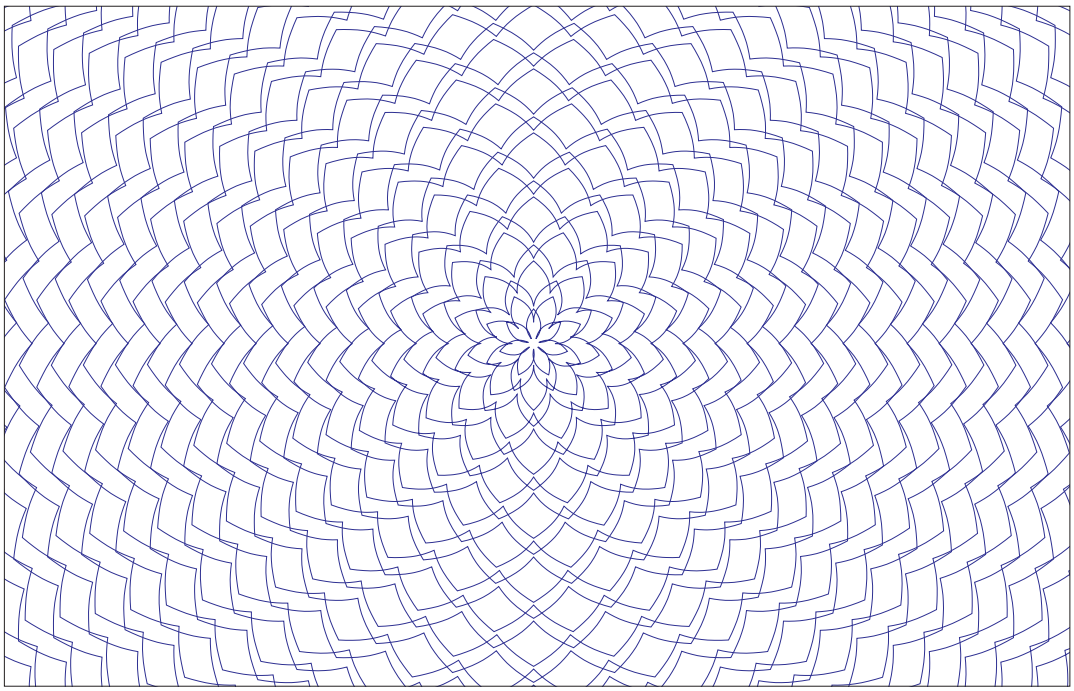
◆ **Example 5:** '**example 5.exc**' shows how you can make complex circular backgrounds with two sets of concentric wavy paths. This time we took the example of '**example 1.exc**' file and added one more **Sine Wave** regular element to **Ellipse** base object with orange path color and following attributes: **Frequency** = '*7*' (the same as that of the first **Sine Wave** element), **Phase** = '*180°*' (this makes waves 'opposite' to waves of the first element), **Amplitude** = '*2.5 pt*' (half as high as waves of the first element). Step & Repeat Set of the both **Sine Wave** elements are identical:



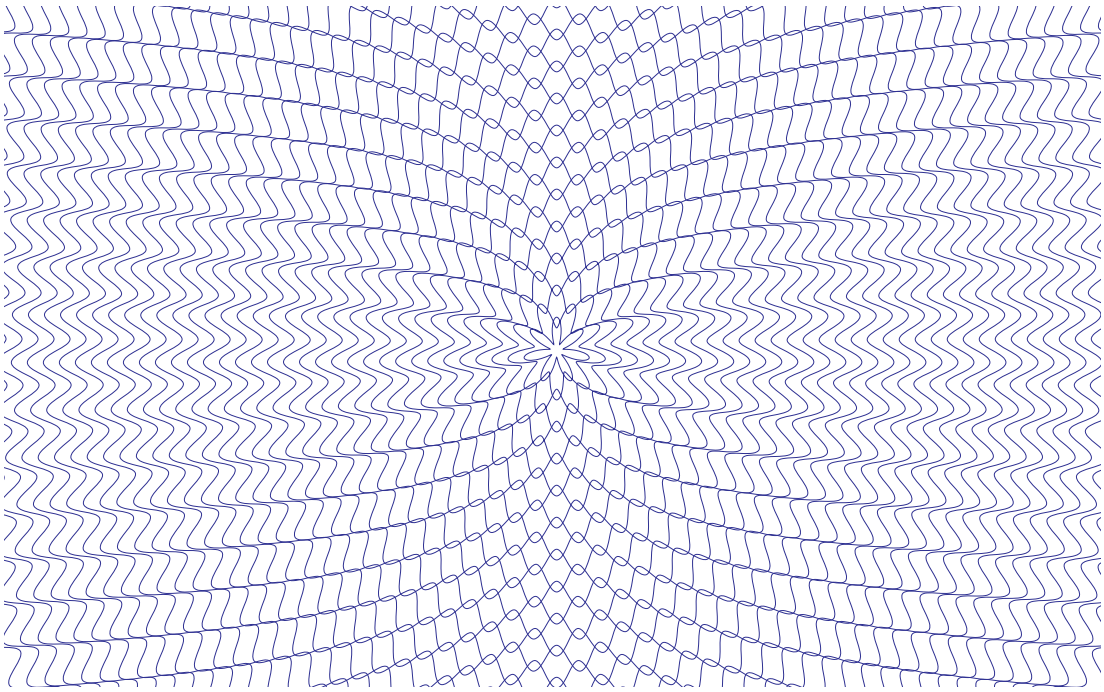


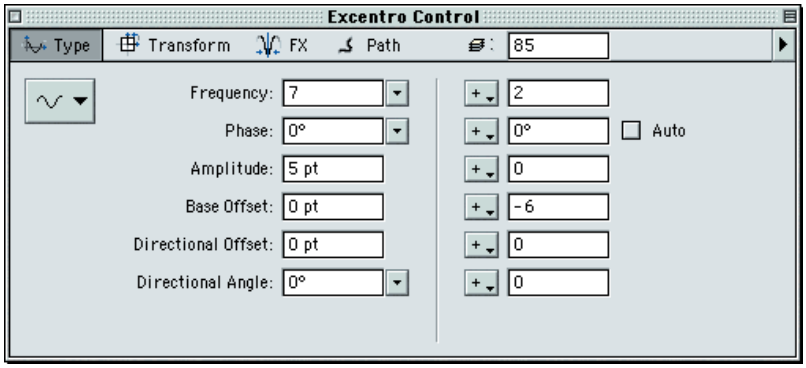
◆ **Example 6:** '**example 6.exc**' file is similar to '**example 1.exc**', but this time we changed type of the regular element to '*Spade*', set its **Amplitude** attribute to '*5.5 pt*', **Side Size** attribute to '*1 pt*' added **Rotation** modification of '*90°*' to Step & Repeat Set. As a result we got almost symmetric top and bottom parts of this background with interesting paths intersections areas:



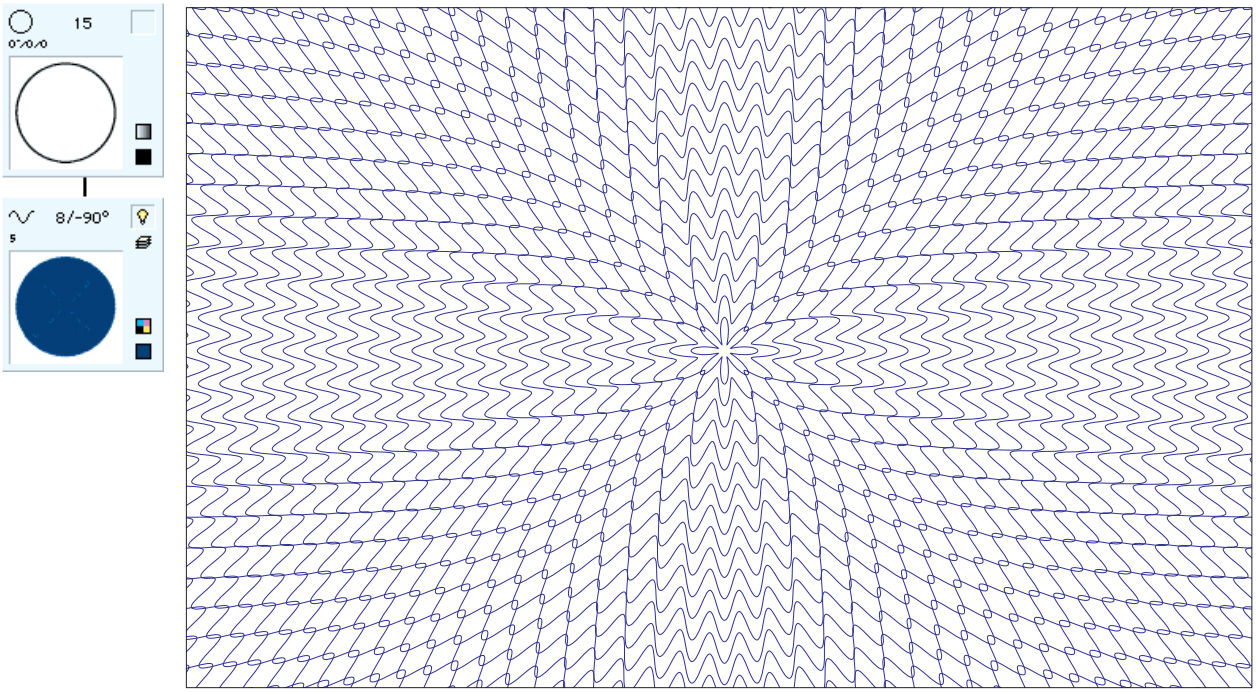


◆ **Example 7:** '**example 7.exc**' file shows how to modify '**Background Template 4.exc**' template and create symmetric bottom and top areas of paths intersections: just open the template file, select **Sine Wave** regular element and set **Frequency** increment value of Step & Repeat Set to '*2*' instead of '*1*'. You should get the following pattern:





◆ **Example 8:** '**example 8.exc**' file is the further modification of '**example 8.exc**' it shows shows how to set **Frequency** increment value of Step & Repeat Set to '*4*' end get four symmetric areas of paths intersections:

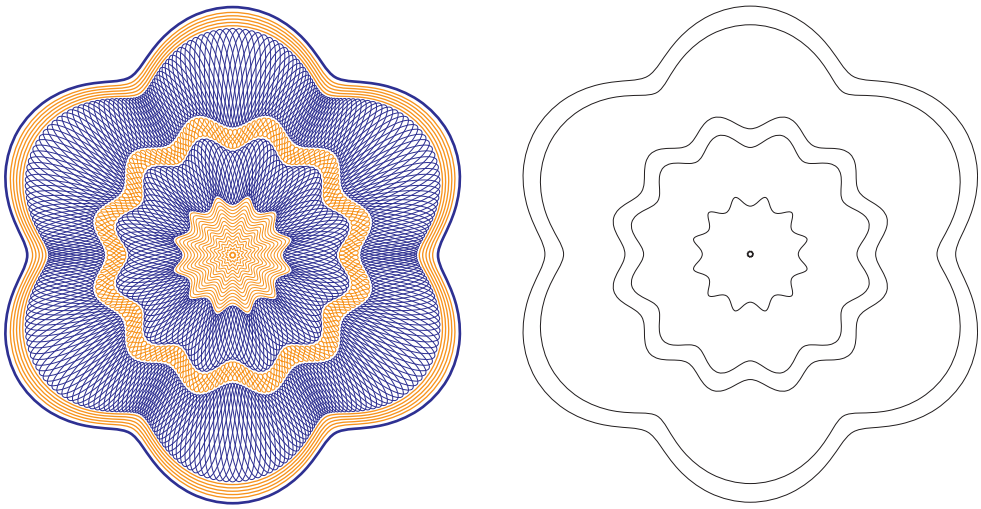


CHAPTER 6: ROSETTES

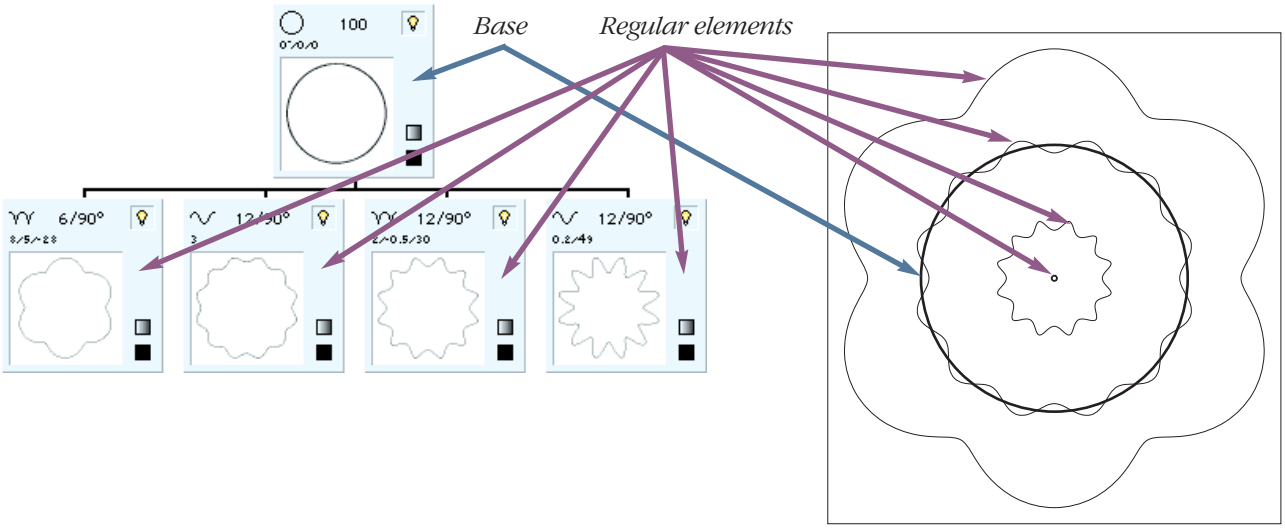
This chapter explains how you can use *Excentro* to create rosettes — circular guilloche designs every certificate or security paper must have. Example we will construct in this chapter is the same as that of stationary file '**Rosette Template 1.exc**' from '**Excentro Templates**' folder. You can use this template to create new rosette designs by modifying attributes of its objects without a need to reconstruct them in new file following all steps described below.

CASE STUDY

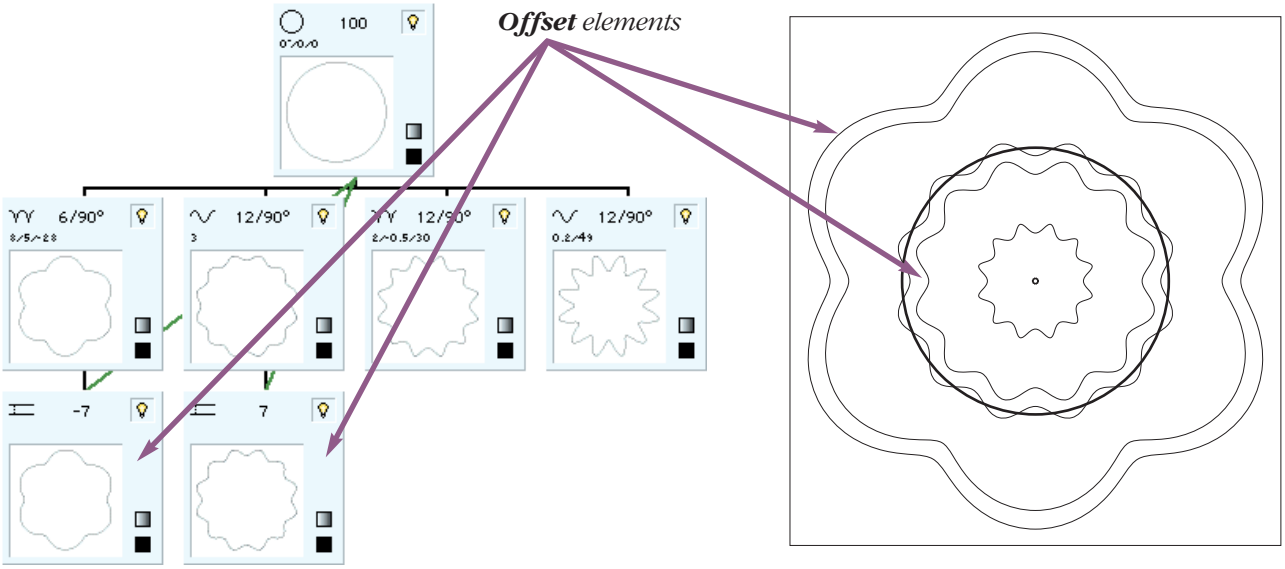
Classic guilloche rosette usually consists of sets of interlacing paths that fill area between several 'skeleton' paths of the design. Left picture below shows finished rosette design while right picture shows only wavy paths that form its skeleton. 'Skeleton' paths are frequently made invisible at the end of the construction process:



Starting points of 'skeleton' paths usually coincide with their end points making these paths closed and adding circular symmetry to the design. Due to this reason and also because most of the rosettes are circular or elliptic in shape: we will use base object of **Ellipse** type for the root object of our design. This **Ellipse** base will be used as a parent object for several regular elements that form 'skeleton' paths. These paths control shape of different rosette areas: central part and two or three external parts. Picture below shows guilloche structure with **Ellipse** base object and regular elements of the skeleton:

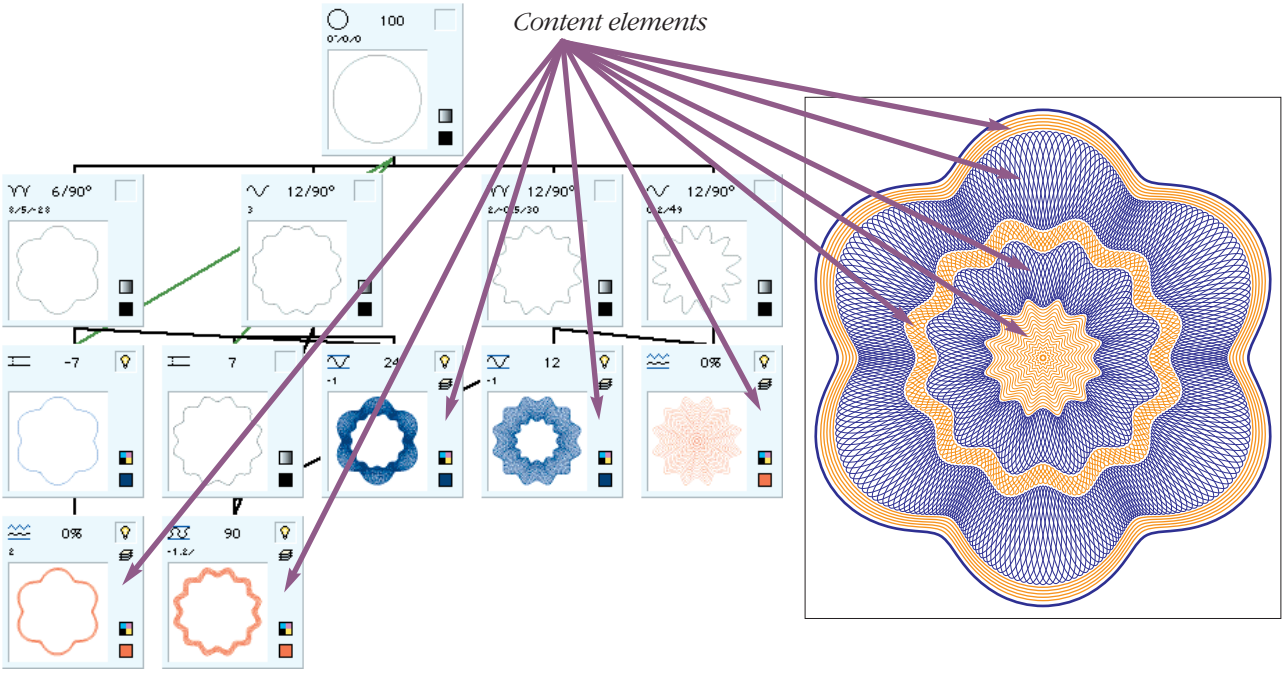


Very frequently rosettes have areas that look like thin circular bands that form, for example, outer border areas of the design. Two sets of orange paths in external areas of the rosette above illustrate the case. To create 'skeleton' paths for these bands we should repeat shapes of already existing regular elements but make them slightly smaller or larger. The easiest way to do so is to use elements of **Offset** type: in this case new paths will change together with the paths of regular elements they use as parents. Guilloche structure bellow adds two **Offset** elements to the design tree shown on previous page:



When whole skeleton of the design is ready all is left to do to finish the design is to add content elements with Step & Repeat Sets between 'skeleton' paths. Step & Repeat Sets should modify **Phase** attribute of content elements to achieve effect of uniform vector texture, or in case of **Blend** content elements Step & Repeat Set should modify their **Ratio** attribute (**Blend** content elements are used in central and border areas of our rosette example).

As the last step we should switch off visibility of **Ellipse** base path and paths of 'skeleton' regular elements that are not needed in finished design. Guilloche structure of finished rosette is shown on following picture:



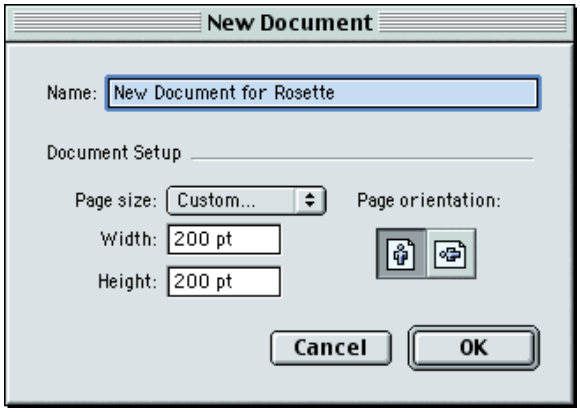
STEP BY STEP ROSETTE CREATION

In this section you can find detailed description of all steps required to create this simple rosette design.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Select proper predefined document size from pop-up menu or enter custom document dimensions.

You can either use some standard document size if this rosette will be a part of some certificate of similar size, this way it will be easier to judge rosette dimensions comparing to other parts of complete design (you can even create the rosette at a new layer of existing document with ready background and borders), or you can use custom document size that will be just enough to accommodate only this rosette, this will simplify preview and scrolling at high magnification values.

In our example we will create rosette with size of about 2.5 inches (6.5 centimeters) in diameter, so let us start with a document of custom size 200x200 points.



Click **OK** button and two windows of new document will appear in front of you:

■ **Step 2: Ellipse Base Object.** As the root object for our rosette design we will use base object of **Ellipse** type. We will make path of this object 'circular' with equal values of **Width** and **Height** attributes. This circle will be positioned in the center of the document.

Choose **New Base** command from **Structure** menu to create new base object. After that in **Excentro Control** inspector choose following options:

◆ '*Ellipse*' from **Type** pop-up menu

Enter following attributes in appropriate fields of **Excentro Control** inspector:

◆ **Width** = '*100 pt*' (let us make the circle half as big as our document size, this will make it easier to create and resize both central and external areas of the rosette)

◆ **Height** = '*100 pt*' (this value is automatically set up if '*Same as Width*' option is chosen from pop-up menu beside this field)

◆ **Angle** = '*0°*' (default initial value)

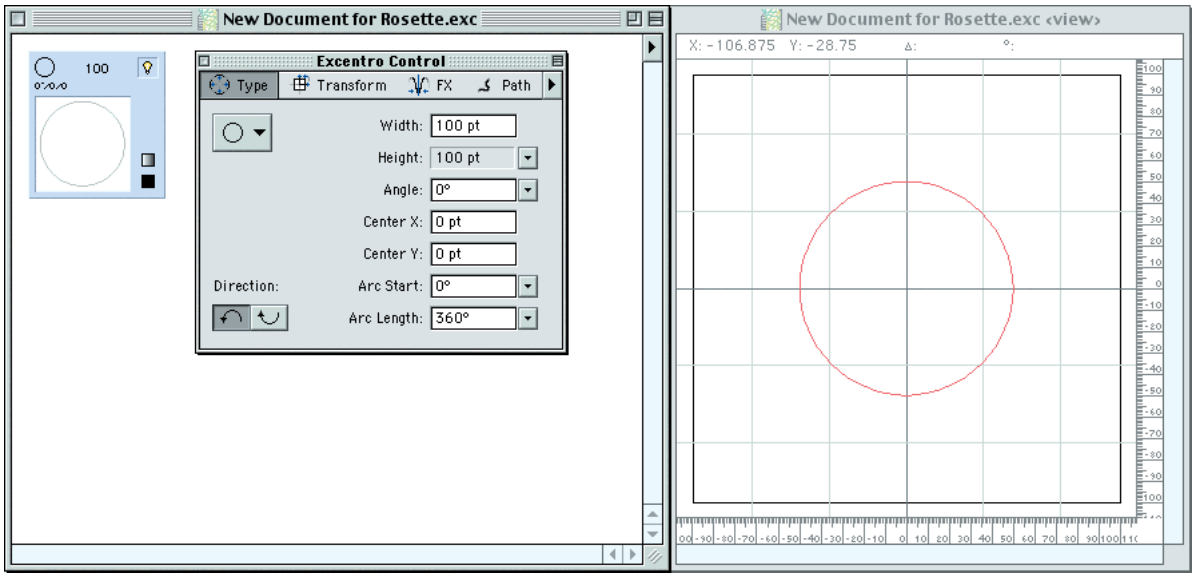
◆ **Center X** = '*0 pt*' (horizontal center position in the document)

◆ **Center Y** = '*0 pt*' (vertical center position in the document)

◆ **Arc Start** = '*0°*' (default initial value)

◆ **Arc Length** = '*360°*' (default initial value that corresponds to full circle arc)

Base creation is finished, you should get following picture on your screen (preview of base circle is shown with red in document preview window because it is the selected object):



■ **Step 3: 'Skeleton' Regular Elements.** Now we will create regular elements that produce paths that form wireframe skeleton of our rosette design. These elements will control shape of the rosette, you will need to modify attributes only of these elements to change dimensions or shapes of all external and central parts of the rosette. By modifying types and attributes of these elements you can make these parts more wavy in shape or, for example, start-like.

Let us start with the external 'skeleton' path from outer border of rosette design, and then create other central 'skeleton' paths one after another.

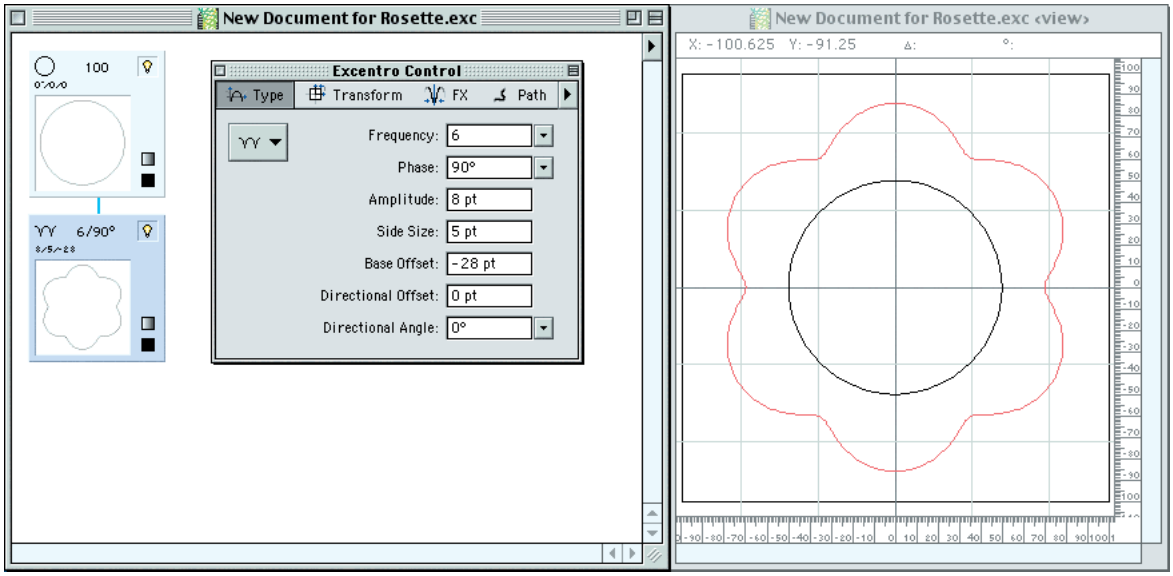
First Element: Select the base object we created in step above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

◆ '*Cycloid*' from **Type** pop-up menu (let us make shape of this path more interesting than simple waves of **Sine Wave** type element)

Enter following attributes in appropriate fields:

- **Frequency** = '*6*' (this path should not have too many 'waves' or 'swells')
- **Phase** = '*90°*' (this will add vertical and horizontal symmetry to the path)
- **Amplitude** = '*8 pt*' (the path should have distinct visible swells)
- **Side Size** = '*5 pt*' (to make the path look like real Cycloid)
- **Base Offset** = '*–28 pt*' (this will offset path by 28 points from circular base path)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The first 'skeleton' regular element is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):



Second Element: You can create the second element by duplicating the first one and modifying its attributes, or you can create completely new element like we will do.

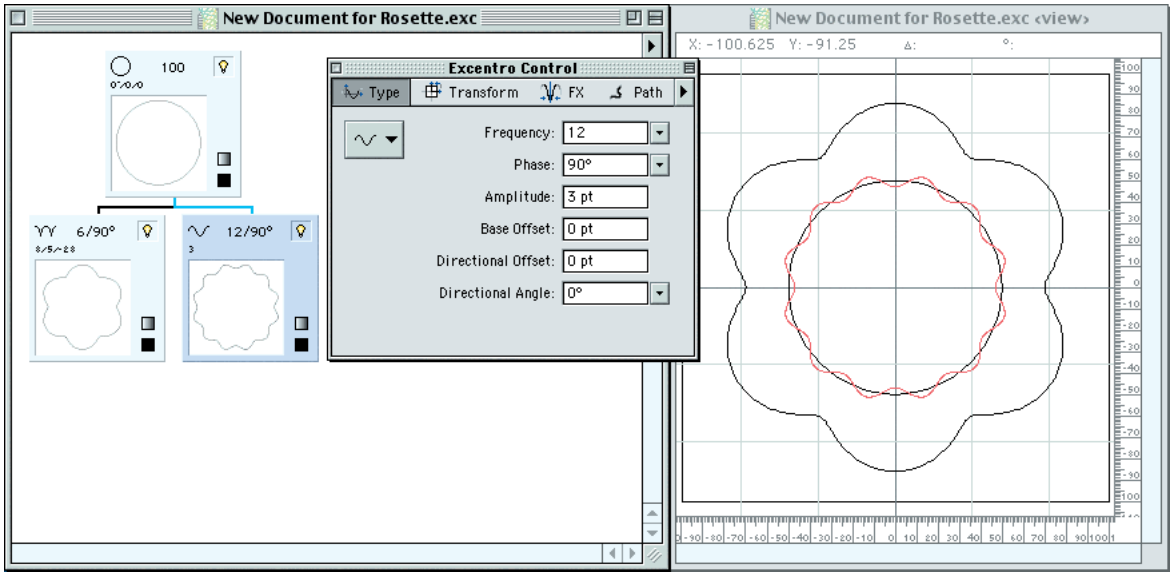
Select the base object with mouse click and choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu (let us make shape of this path different from the first one)

Enter following attributes in appropriate fields:

- **Frequency** = '*12*' (this path will be more wavy than the first one)
- **Phase** = '*90°*' (this will add vertical and horizontal symmetry to the path)
- **Amplitude** = '*3 pt*' (this path will be positioned closer to the center of the design, so let us make its waves slightly lower)
- **Base Offset** = '*0 pt*' (this path will be placed right on the circular path of the base object)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The second 'skeleton' regular element is ready, you should get following picture (see picture on next page) on your screen (preview of the path is shown with red because it is selected):



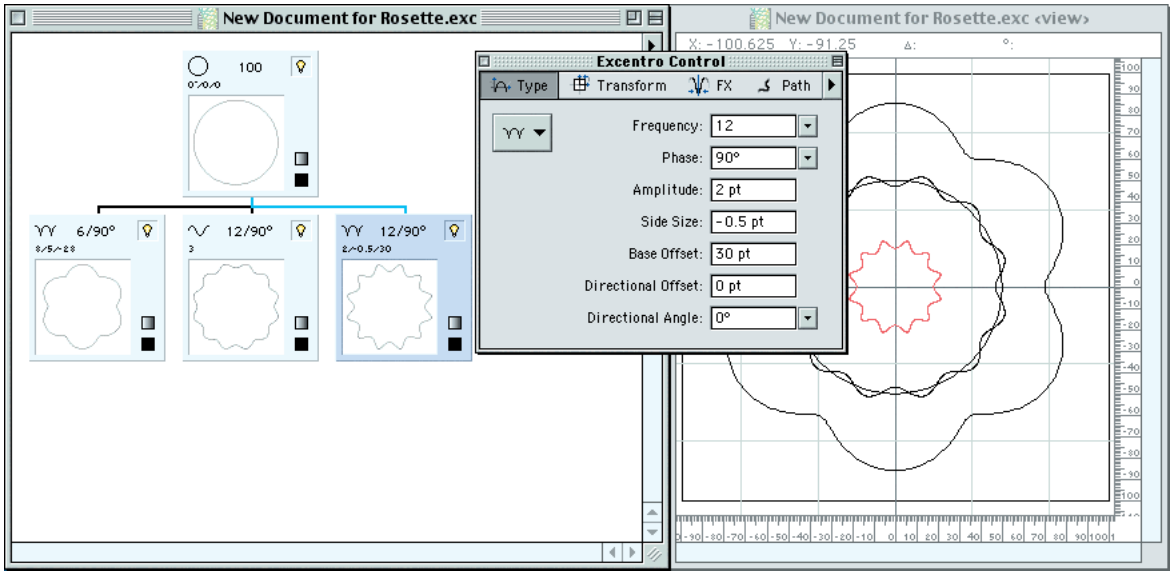
Third Element: Select the base object with mouse click and choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Cycloid*' from **Type** pop-up menu (let us make shape of this path Cycloid-like too)

Enter following attributes in appropriate fields:

- **Frequency** = '*12*' (same value as that of the second path)
- **Phase** = '*90°*' (same value as that of the second path)
- **Amplitude** = '*2 pt*' (this value should be even smaller than that of the second path, because the path will be positioned closer to the center)
- **Side Size** = '*–0.5 pt*' (to make the path look like Cycloid with swells opposite to the swells of the first Cycloid)
- **Base Offset** = '*30 pt*' (this will offset path by 30 points closer to the center from circular path of base object)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The third 'skeleton' regular element is ready:



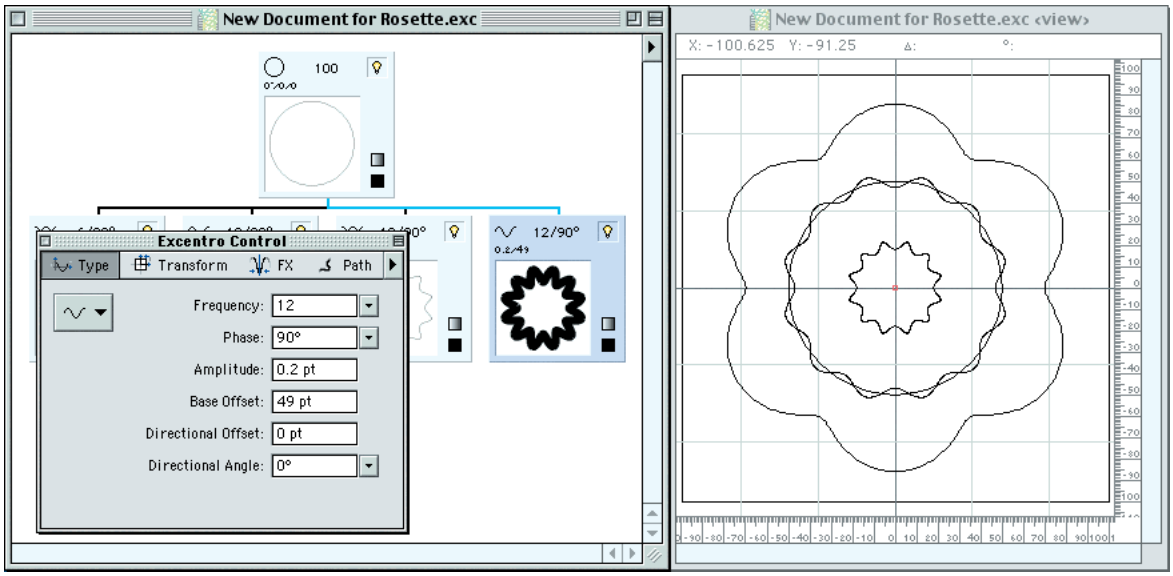
Fourth Element: Select the base object with mouse click and choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- ‘*Sine Wave*’ from **Type** pop-up menu (let us make shape of this path the same as that of the second element)

Enter following attributes in appropriate fields:

- **Frequency** = ‘*12*’ (same value as that of the second path)
- **Phase** = ‘*90°*’ (same value as that of the second path)
- **Amplitude** = ‘*0.2 pt*’ (this path will be positioned closer to the center of the design, so let us make its waves very low)
- **Base Offset** = ‘*49 pt*’ (this path will be placed as close to the center as possible)
- **Directional Offset** = ‘*0 pt*’ (default initial value)
- **Directional Angle** = ‘*0°*’ (default initial value)

The fourth ‘skeleton’ regular element is ready, you should get the following picture (preview of the path is shown with red because it is selected):



■ **Step 4: Offset Elements.** Our rosette will have two areas with thin band-like patterns. To create ‘skeleton’ paths for this areas we will use regular elements of **Offset** type that allow us to create paths of the same shape as that of original elements at specified distance.

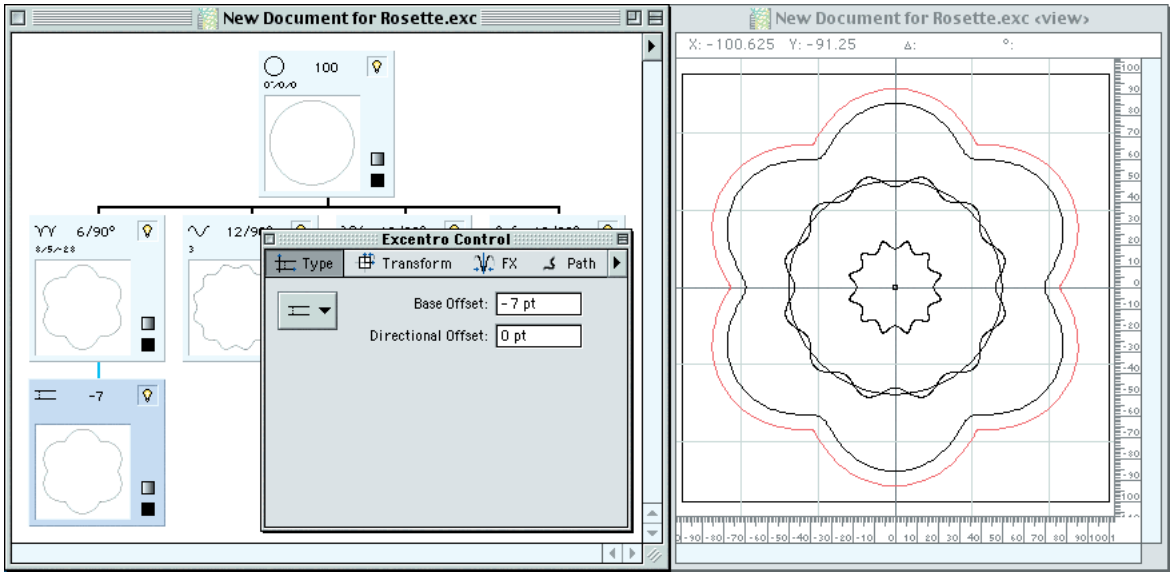
First Element: Let us create the element whose path will form external border of our rosette design. Select the first regular element we created in previous step with mouse click and choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- ‘*Offset*’ from **Type** pop-up menu

Enter following attributes in appropriate fields:

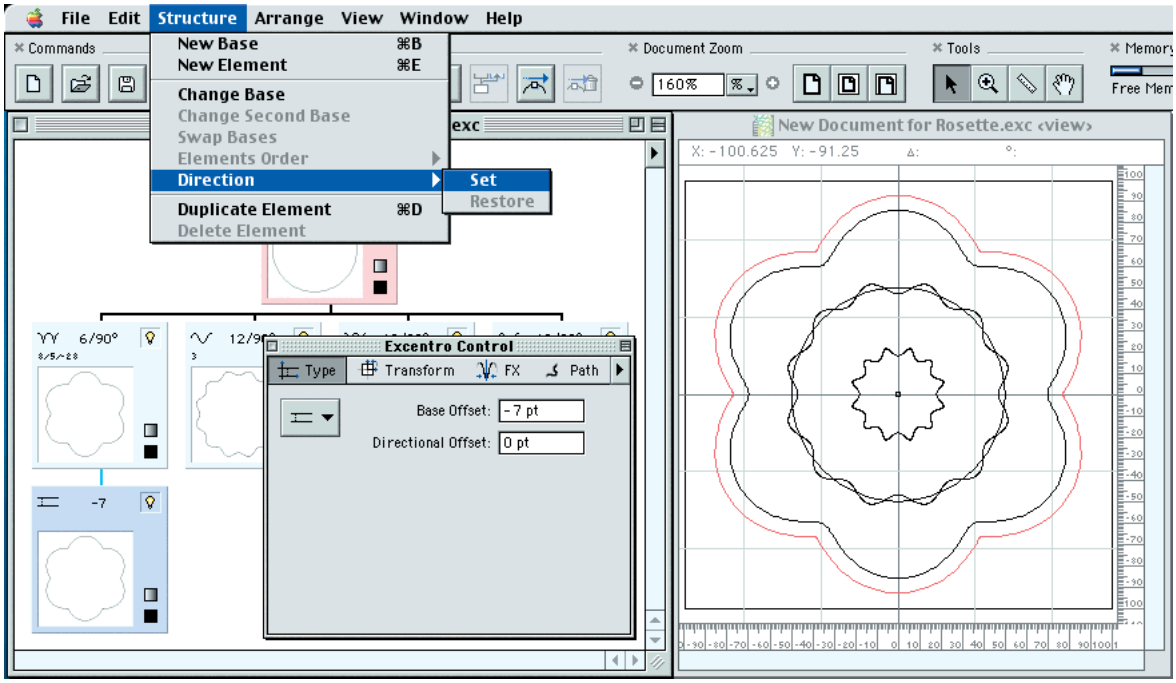
- **Base Offset** = ‘*–7 pt*’ (this will offset new path by 7 points from path of the first regular element, making it larger)
- **Directional Offset** = ‘*0 pt*’ (default initial value)

The first **Offset** element is created, you should get following picture on your screen (preview of the path is shown with red because it is selected):



We will construct content element between **Offset** element and its parent element in next step. To make paths of future content element more smooth we need to correct 'direction' of **Offset** element's path.

Select **Offset** element we created above with mouse click, then press down **Shift** modifier key on your keyboard and click **Ellipse** base object's representation in main document window. Choose **Set** command from **Direction** submenu of **Structure** menu:



Direction of **Offset** element was corrected. Please, note that green line appeared between **Offset** regular element and **Ellipse** base object in main document window (see picture on next page).

Second Element: Let us create the second **Offset** element whose path will offset the path of the second regular element we created in **Step 3**. Select the second regular element we created in previous step with mouse click and choose **New Element** command

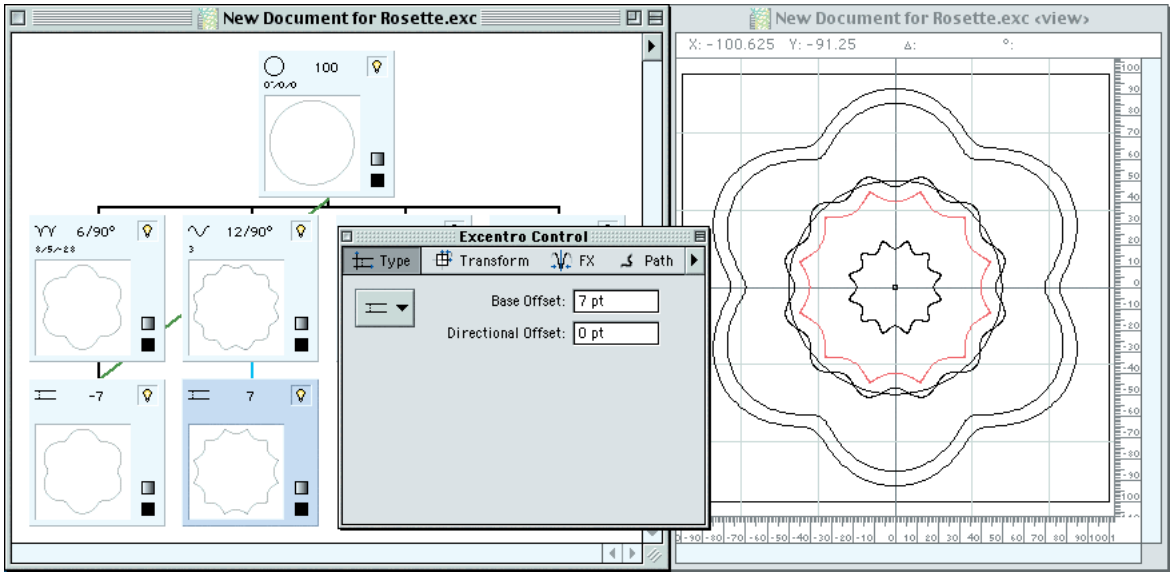
from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- ‘*Offset*’ from **Type** pop-up menu

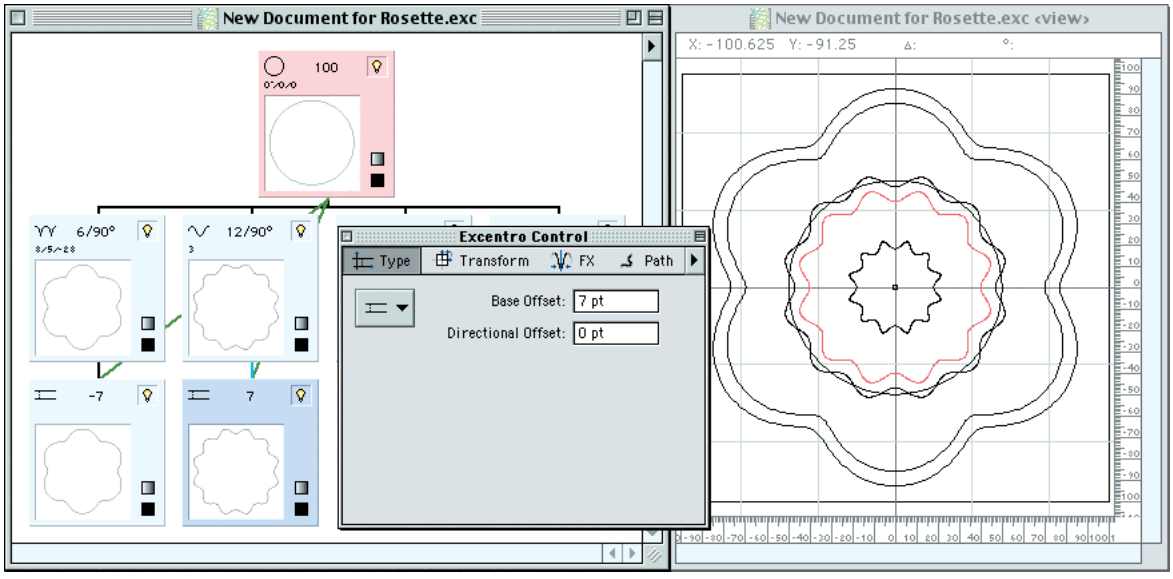
Enter following attributes in appropriate fields:

- **Base Offset** = ‘*7 pt*’ (this will offset new path by 7 points from path of the second regular element closer to the center of the design)
- **Directional Offset** = ‘*0 pt*’ (default initial value)

The second **Offset** element is created, you should get following picture on your screen (preview of the path is shown with red because it is selected):



We should correct ‘direction’ of the second **Offset** element’s path, just like we did with the first one. Select **Offset** element we created above with mouse click, then press down **Shift** modifier key on your keyboard and click **Ellipse** base object’s representation in main document window. Choose **Set** command from **Direction** submenu of **Structure** menu. Direction of the second **Offset** element was corrected. Please, note that green line appeared between **Offset** regular element and **Ellipse** base object in main document window.



■ **Step 5: Content Elements.** In steps **3** and **4** we created all 'skeleton' paths of our rosette design. Now we will add content elements with Step &Repeat Sets that form 'vector texture' of the rosette. Just like with regular elements, we will start with external areas of the rosette and then we will create central ones one after another.

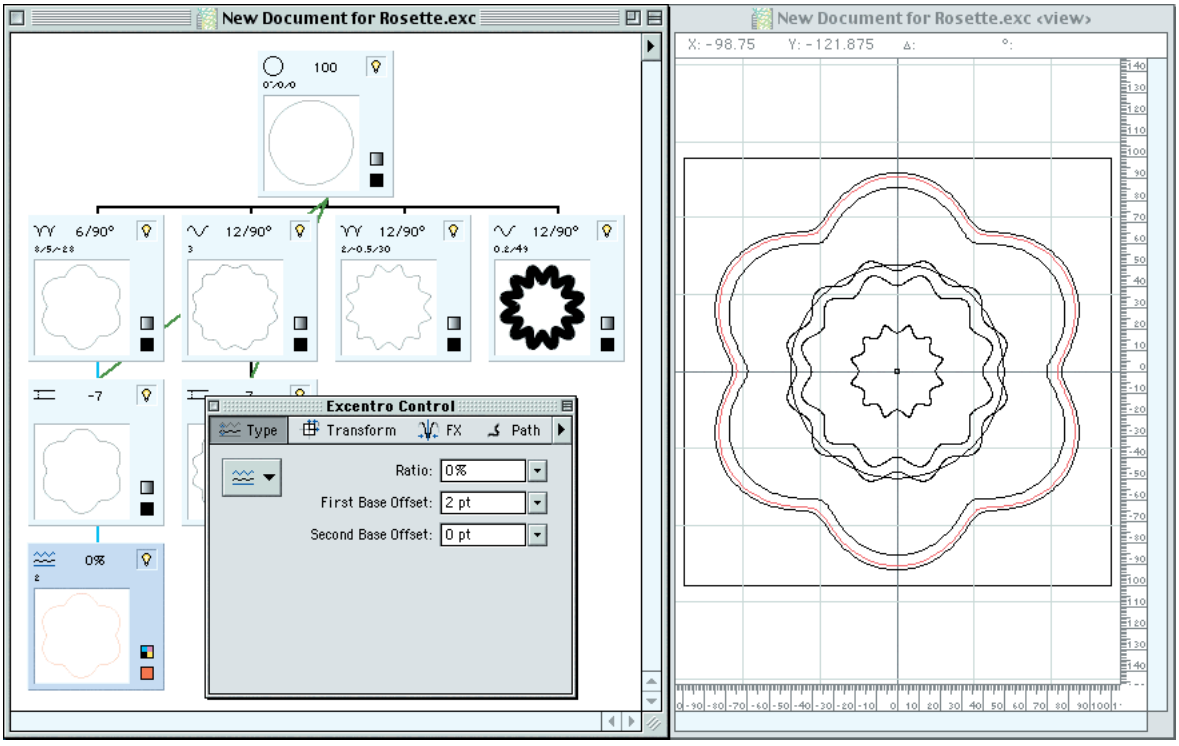
First Content Element: Paths of this content element will form thin band-like pattern on the external border of the rosette. Select the first **Offset** element we created in **Step 4** with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the first regular element we created in **Step 3**. Rectangular representation of the first clicked element in main document window should become blue (color for the selected object), rectangular representation of the second element should become reddish (color for the second selected object). Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

- '*Blend*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

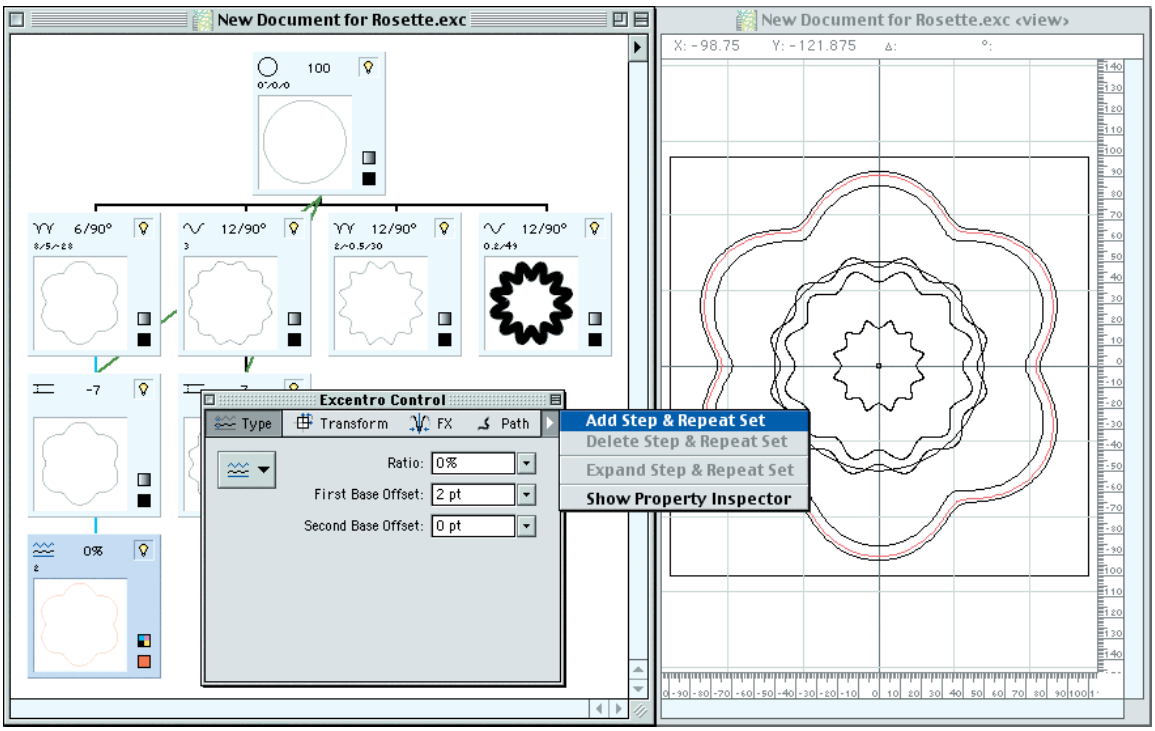
- **Ratio** = '*0%*' (we are going to apply Step & Repeat Set to this object later, to cover whole [0%; 100%] interval, let us set initial value of first original path to 0%)
- **First Base Offset** = '*2 pt*' with '*Distance with Base Direction*' option in pop-up menu beside this field (let us offset this path by 2 points from the path of the first **Offset** element)
- **Second Base Offset** = '*0 pt*' (default initial value)

You should get following picture on your screen (preview of content element's path is shown with red because it is selected):



Let us apply stroke and color attributes to the path of this content element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 150–200 microns or 0.4–0.5 points (we want vector paths to become visible, but not too thick). Mix appropriate color in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control** or to rectangular representation of this element in main document window (for example, let it be some orange color).

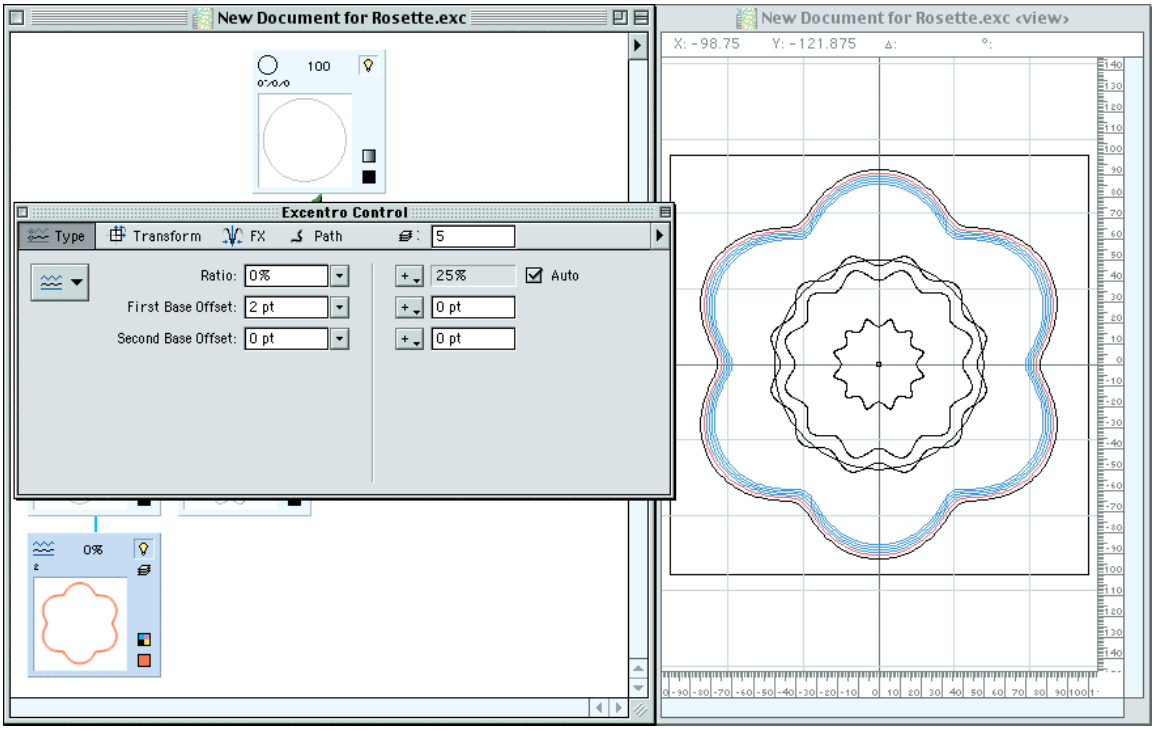
Now we will apply Step & Repeat Set modification to this content element that will create the rest this band pattern's paths. Select the content element with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu.



Enter following values in fields of new Step & Repeat Set:

- **Number of Steps** = '5' (this will make a set of 5 paths: original path of the content element and 4 additional paths)
- **Ratio** — click **Auto** checkbox beside numeric field and **Ratio** attribute value will be automatically calculated so that 5 paths cover whole [0%; 100%] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



Second Content Element: Paths of this content element form vector pattern between paths of the first and the second regular elements we created in **Step 3**. Select the second regular element created in **Step 3** with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the first regular element created in **Step 3**. Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

◆ '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

◆ **Frequency** = '*24*' (four times higher than **Frequency** of the first regular element and two times higher than **Frequency** of the second regular element)

◆ **Phase** = '*0°*' (default initial value, no need to change it, Step & Repeat Set will modify this value for other copies of this element's paths)

◆ **First Base Offset** = '*–1 pt*' with '*Distance with Base Direction*' option in pop-up menu beside this field (1 point offset from the paths of regular elements)

◆ **Second Base Offset** = '*–1 pt*' (this value is automatically set by '*Same as First Base Offset*' option in pop-up menu beside this field)

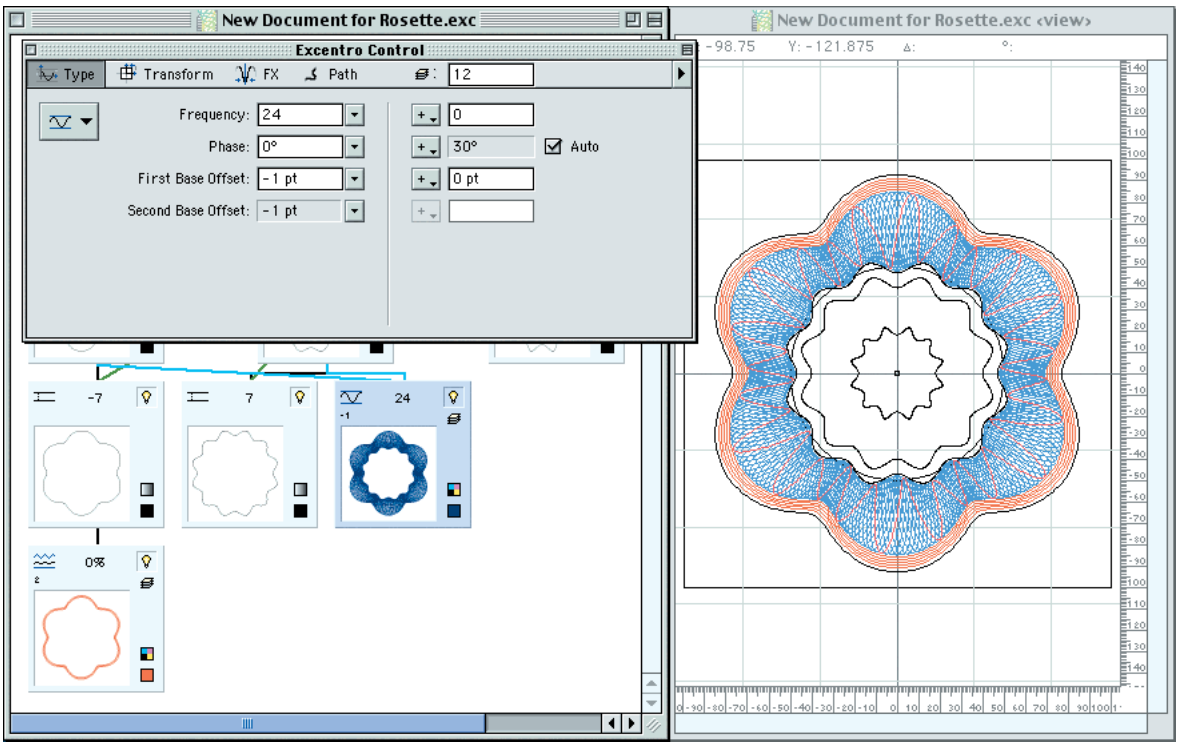
Apply stroke and color attributes to the path of this element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be some blue color) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Add Step & Repeat Set modification to this element with **Add Step & Repeat Set** command from **Excentro Control** window menu. Enter following values in fields of new Set:

◆ **Number of Steps** = '*12*' (this will make a set of 12 paths: original path of the content element and 11 additional copies)

◆ **Phase** — click **Auto** checkbox beside numeric field and **Phase** attribute value will be automatically calculated so that 12 paths of the content element cover whole [0°; 360°] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



Third Content Element: Paths of this content element form vector pattern between paths of the second **Offset** element and the second regular element. Select the second **Offset** element created in **Step 4** with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the second regular element created in **Step 3**. Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

- '*Eight*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

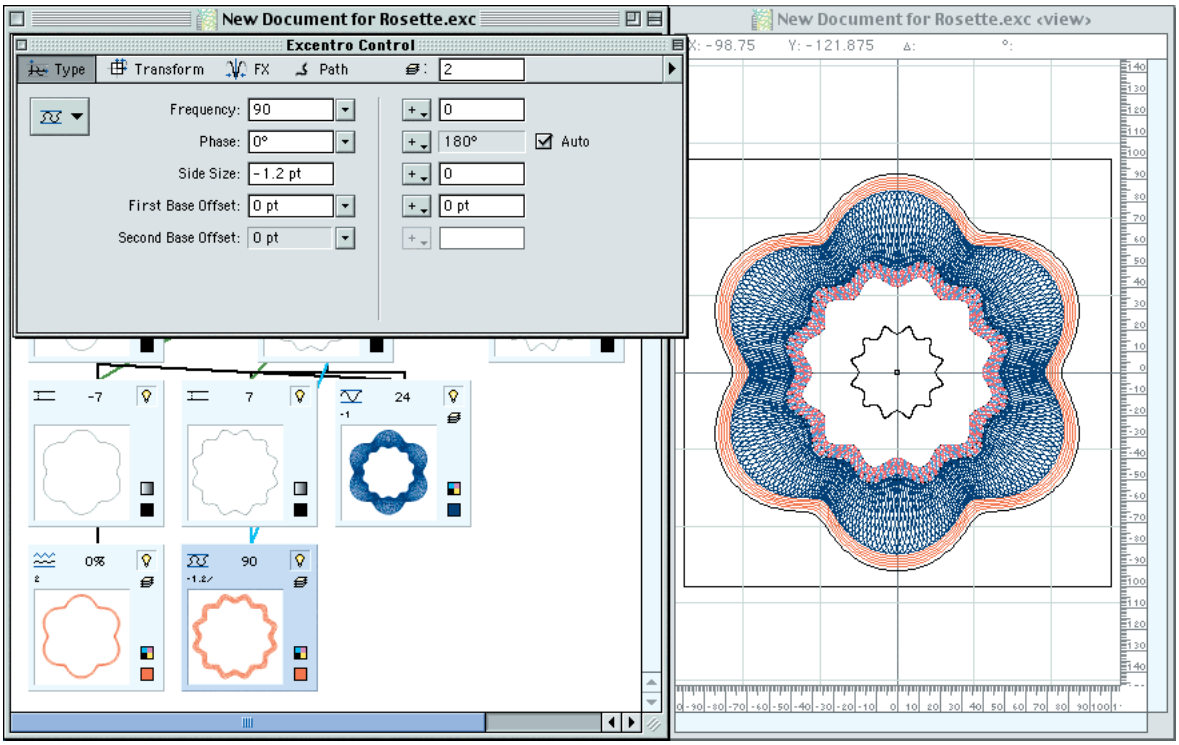
- **Frequency** = '*90*' (this is **Eight** type element, so let us make its **Frequency** high with small number of Step & Repeat Set paths)
- **Phase** = '*0°*' (default initial value, no need to change it, Step & Repeat Set will modify this value for other copies of this element's paths)
- **Side Size** = '*–1.2 pt*' (this will make the path of **Eight** type element look different from plain wavy path you can get with default '*0 pt*' value)
- **First Base Offset** = '*0 pt*' (default initial value)
- **Second Base Offset** = '*0 pt*' (default initial value)

Apply stroke and color attributes to the path of this element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be same orange color as that of the first content element) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Add Step & Repeat Set modification to this element with **Add Step & Repeat Set** command from **Excentro Control** window menu. Enter following values in fields of the Set:

- **Number of Steps** = '*2*' (this will make a set of 2 paths: original path of the content element and one additional copy)
- **Phase** — click **Auto** checkbox beside numeric field and **Phase** attribute value will be automatically calculated so that two paths of the content element cover whole [0°; 360°] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



Fourth Content Element: Paths of this content element form vector pattern between paths of the third regular element and the second **Offset** element. Select the third regular element created in **Step 3** with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the the second **Offset** element created in **Step 4**. Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

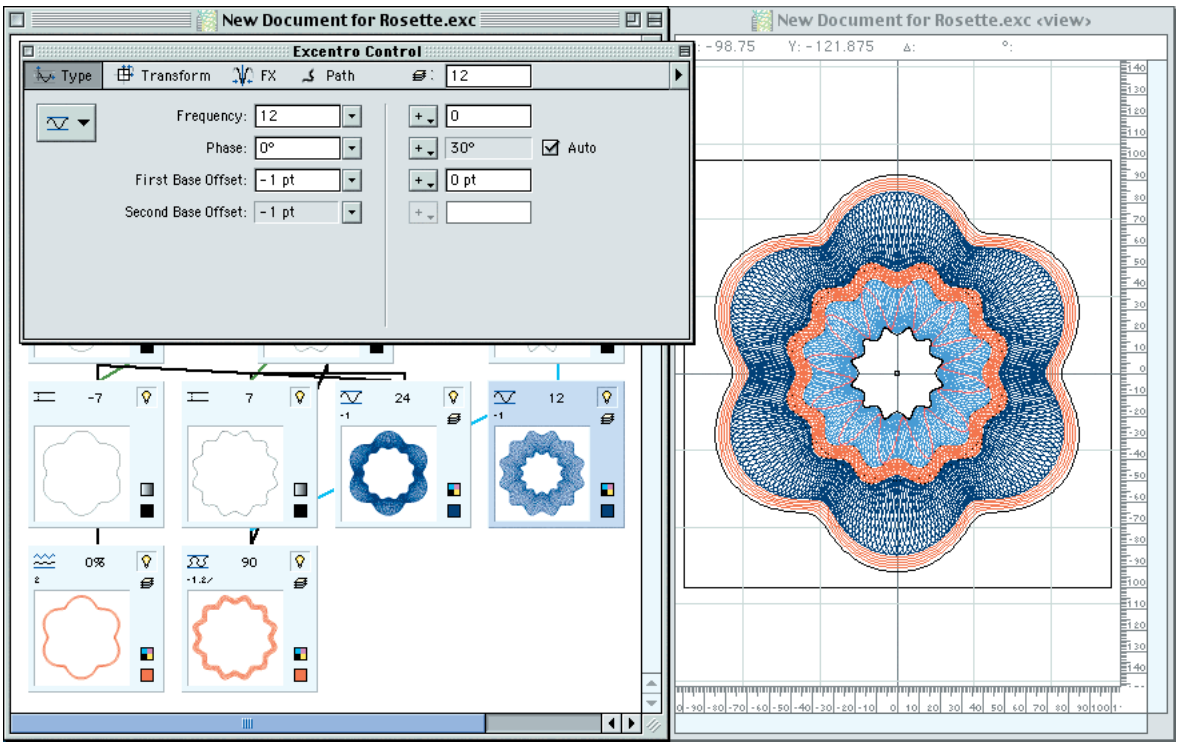
- **Frequency** = '*12*' (the same as **Frequency** of the third regular element)
- **Phase** = '*0°*' (default initial value, no need to change it, Step & Repeat Set will modify this value for other copies of this element's paths)
- **First Base Offset** = '*–1 pt*' with '*Distance with Base Direction*' option in pop-up menu beside this field (1 point offset distance from the paths of its parent elements)
- **Second Base Offset** = '*–1 pt*' (this value is automatically set by '*Same as First Base Offset*' option in pop-up menu beside this field)

Apply stroke and color attributes to the path of this element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be the same blue color as that of the second content element) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Add Step & Repeat Set modification to this element with **Add Step & Repeat Set** command from **Excentro Control** window menu. Enter following values in fields of the Set:

- **Number of Steps** = '*12*' (this will make a set of 12 paths: original path of the content element and 11 additional copies)
- **Phase** — click **Auto** checkbox beside numeric field and **Phase** attribute value will be automatically calculated so that 12 paths of the content element cover whole [0°; 360°] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



Fifth Content Element: Paths of this content element form vector pattern between paths of the third and the fourth regular elements. This is the central piece of our rosette design. Select the fourth regular element we created in **Step 3** with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the third regular element created in **Step 3**. Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

- '*Blend*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

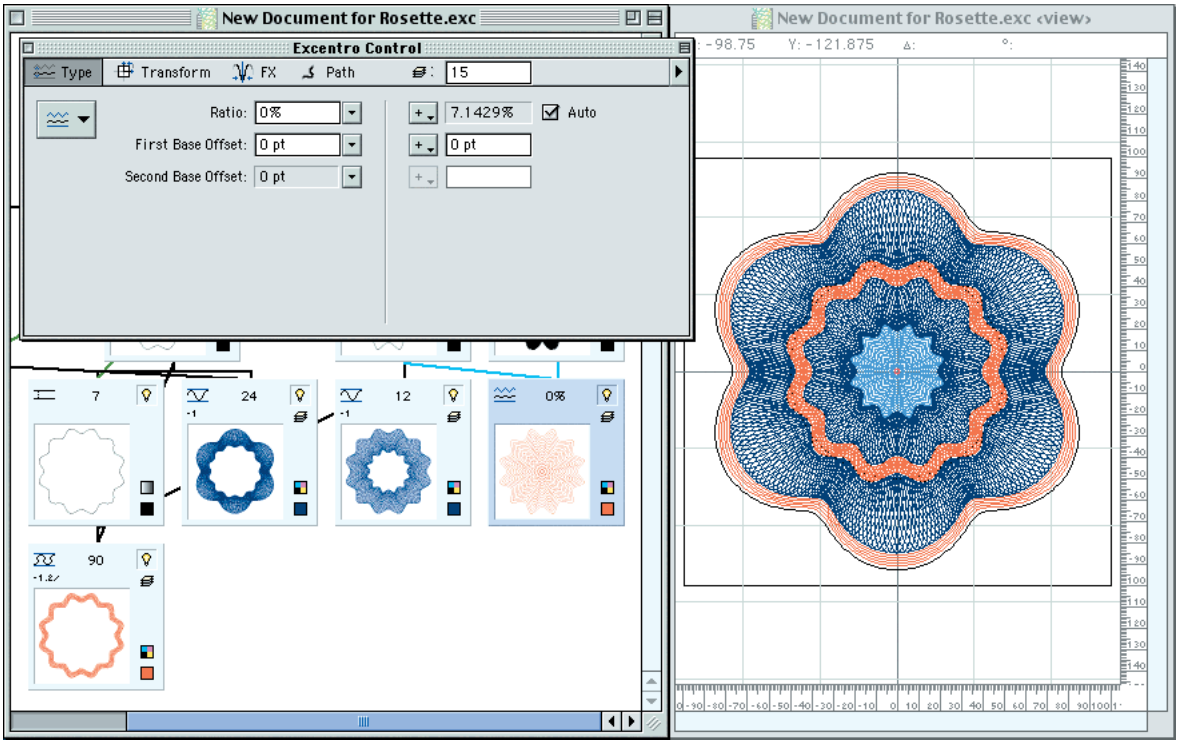
- **Ratio** = '*0%*' (we are going to apply Step & Repeat Set to this object to cover whole [0%; 100%] interval, let us set initial value of the first original path to 0%, so it will coincide with the path of the fourth regular element)
- **First Base Offset** = '*0 pt*' (default initial value)
- **Second Base Offset** = '*0 pt*' (default initial value)

Apply stroke and color attributes to the path of this element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be same orange color as that of the first and the third content elements) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Add Step & Repeat Set modification to this element by choosing **Add Step & Repeat Set** command from **Excentro Control** window menu. Enter following values in fields of the new Set:

- **Number of Steps** = '*15*' (this will make a set of 15 paths: original path of the content element and 14 additional paths)
- **Ratio** — click **Auto** checkbox beside numeric field and **Ratio** attribute value for paths of the Step & Repeat Set will be automatically calculated so that 15 paths cover whole [0%; 100%] interval

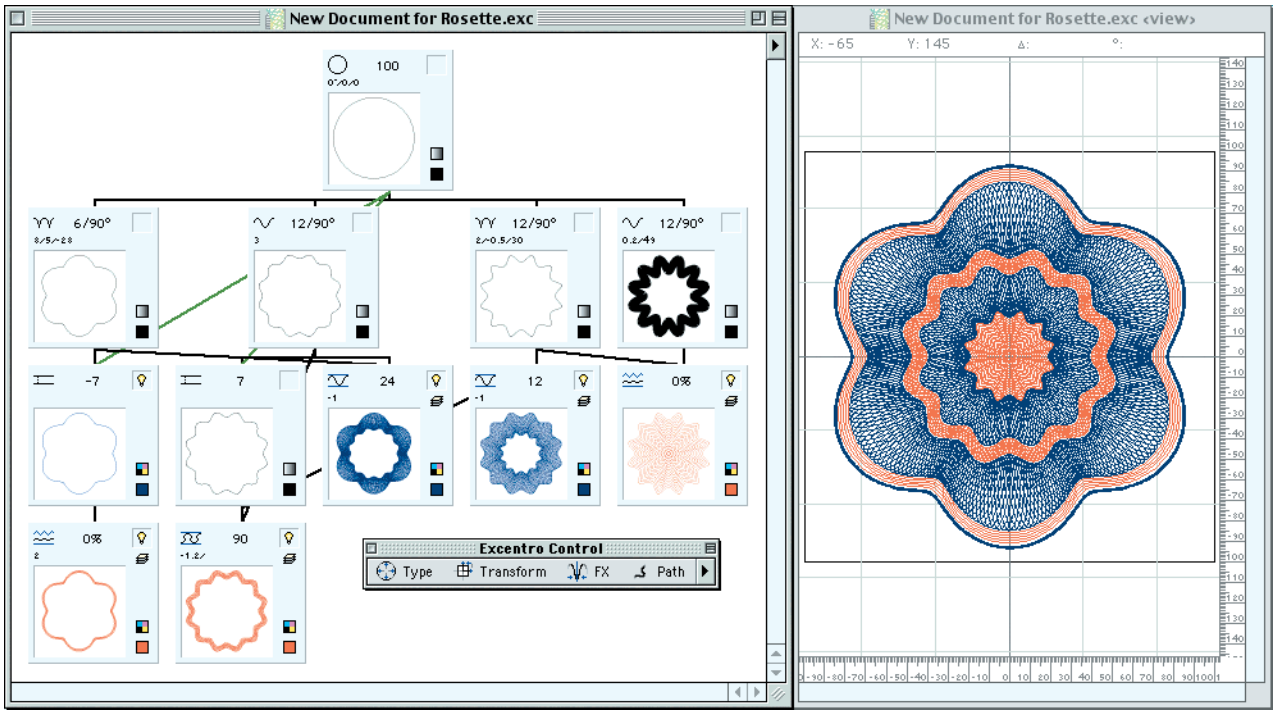
Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



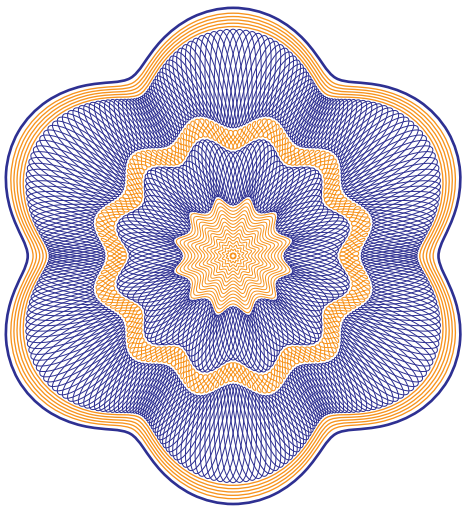
The construction of the rosette is finished. As the very last step switch to to **Path** panel of **Excentro Control** inspector and switch off **Visible** check box for **Ellipse** base object, all of the regular skeleton elements and the second **Offset** element to make these paths invisible.

The path of the first **Offset** element forms the border of our rosette. Let us keep it visible and make its stroke weight thicker than that of other paths of the rosette. Select this element, switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 350–400 microns or about 1 point. Mix appropriate color (let it be same blue color as that of the second and the fourth content elements) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Final rosette picture and guilloche tree structure should look exactly like the ones shown below or on the first page of this chapter:



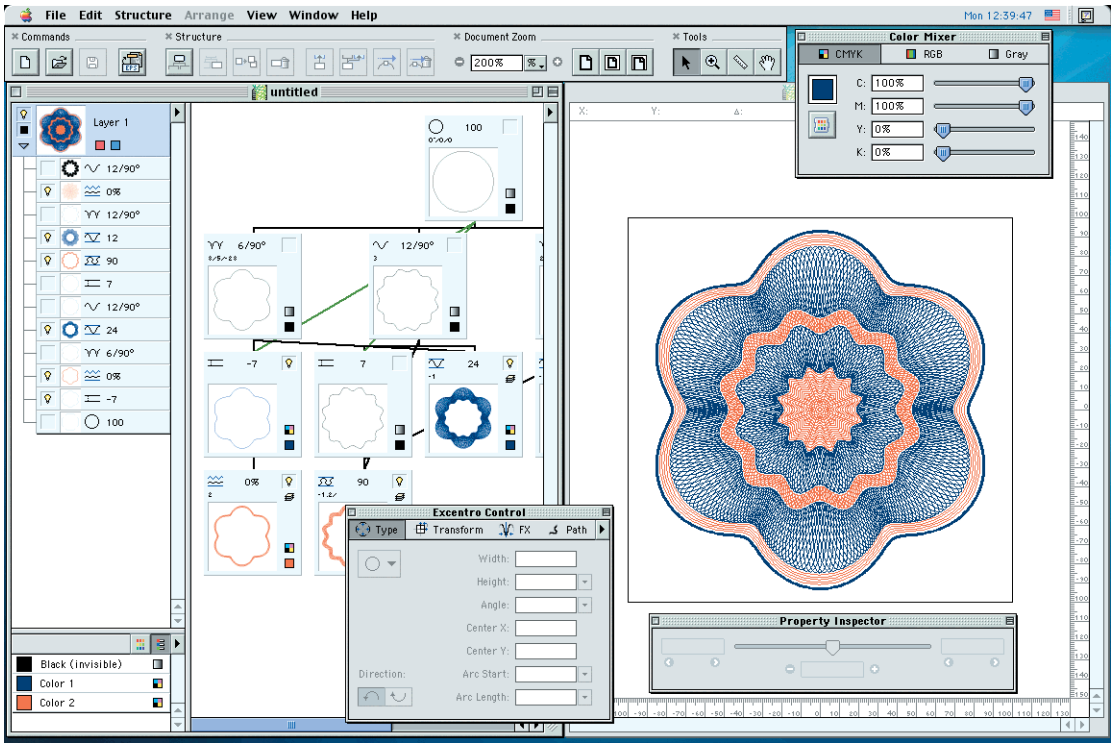
Now you can export this rosette in *Adobe Illustrator* format using **Export** command from **File** menu and use it as part of certificate, diploma, etc. Below is one more picture of the rosette in vector form:



TEMPLATE AND EXAMPLES

Stationary file '**Rosette Template 1.exc**' from '**Excentro Templates**' folder contains a copy of the document we created in previous section. You can use this template to create new rosettes by modifying attributes of its objects without a need to reconstruct them in new file as was described above.

■ **Template Usage.** Launch *Excentro* application and open '**Rosette Template 1.exc**' file. New **untitled** document that contains copy of stationary file content will be opened in front of you:



Save this new document to whatever location on your hard disk you use for guilloche designs giving it meaningful name. Now you can modify objects attributes and create your custom rosettes from this template:

◆ You can change color attribute of the objects. The easiest way to do so is to redefine '*Color 1*' and '*Color 2*' entries in the document colors list. Just drag color patch from **Color Mixer** or swatch palette window to color patches (small colored rectangles) of '*Color 1*' or '*Color 2*'. This will automatically change color attributes of objects that use this colors list entry.

◆ You can modify objects attributes. For example: change of object's **Type** will modify its shape making it 'saw-like' or 'tooth-like' instead of wavy or cycloid; change of object's **Frequency** will add or reduce number of waves or coils its shape has; change of **Side Size** of the **Cycloid** will make its coils smaller or larger, etc.

◆ You can add new elements to the rosette. This will increase number of paths the rosette consists of making pattern more complex and interesting.

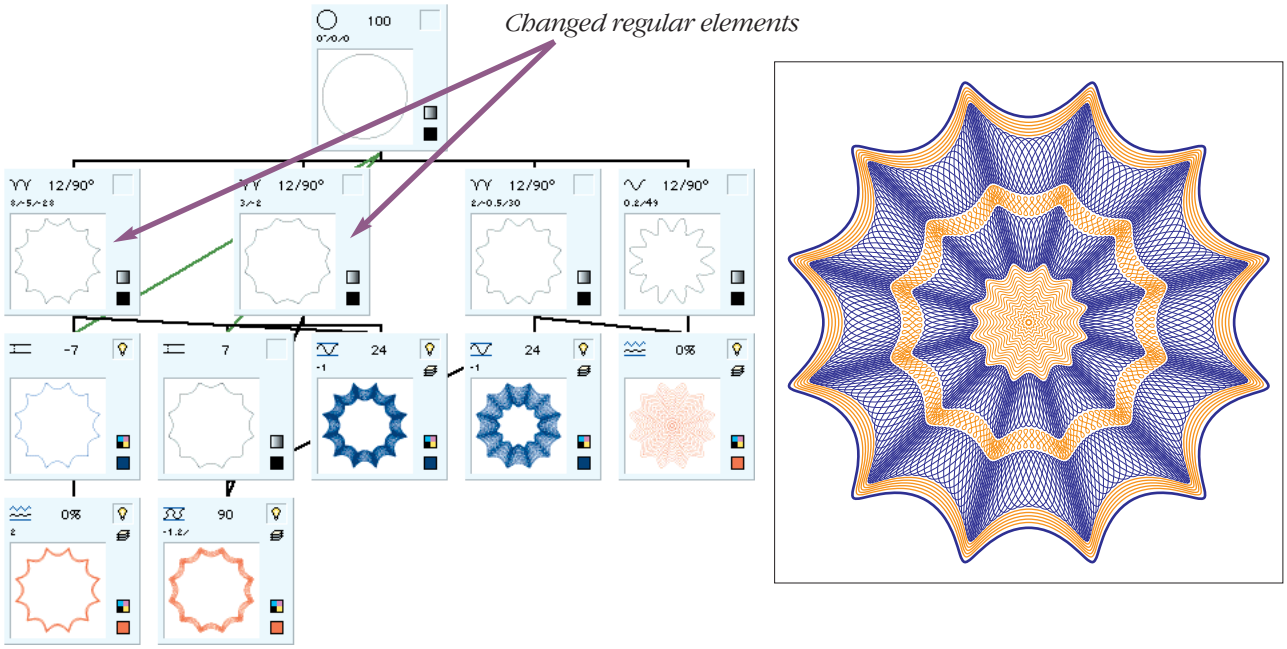
◆ You can modify attributes of Step & Repeat Set changing number of paths that form the rosette or shape of these paths.

Examples of this template usage are located in '**Rosette Template 1 examples**' folder. They show most typical variations you can create using '**Rosette Template 1.exc**' template.

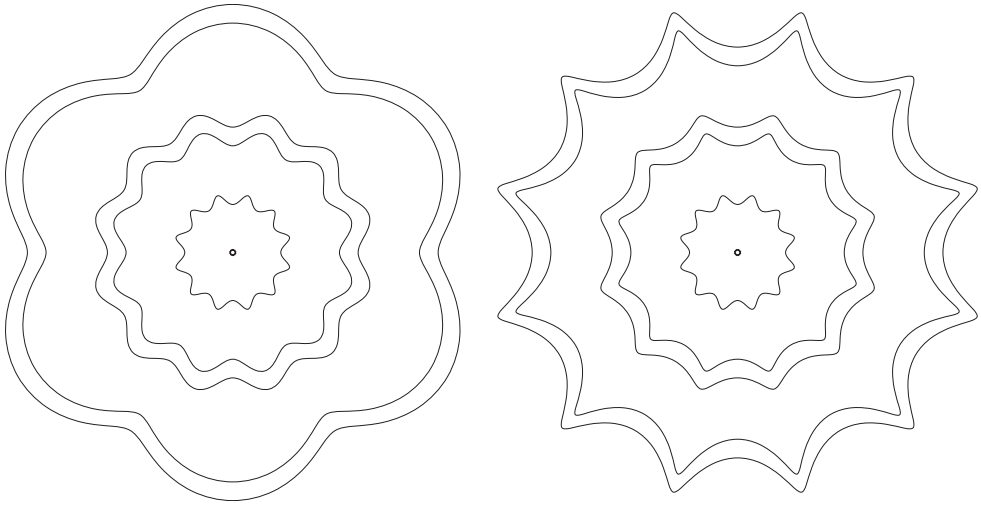
Let us take a quick look at examples of '**Rosette Template 1.exc**' variations from '**Rosette Template 1 examples**' folder.

■ **Rosette Shape Variations.** First five examples show how you can modify shape of the rosette or shapes of its external and central areas by changing attributes of several regular elements that form its 'skeleton bones'.

◆ **Example 1:** In this example we modified shapes of the first two regular elements to make our rosette design look more like a 'spider web'. To achieve this we changed **Type** of both elements to '*Cycloid*'. The first element now has following attributes: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*8 pt*', **Side Size** = '*–5 pt*', **Base Offset** = '*–28 pt*'. The second element: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*3 pt*', **Side Size** = '*–2 pt*':

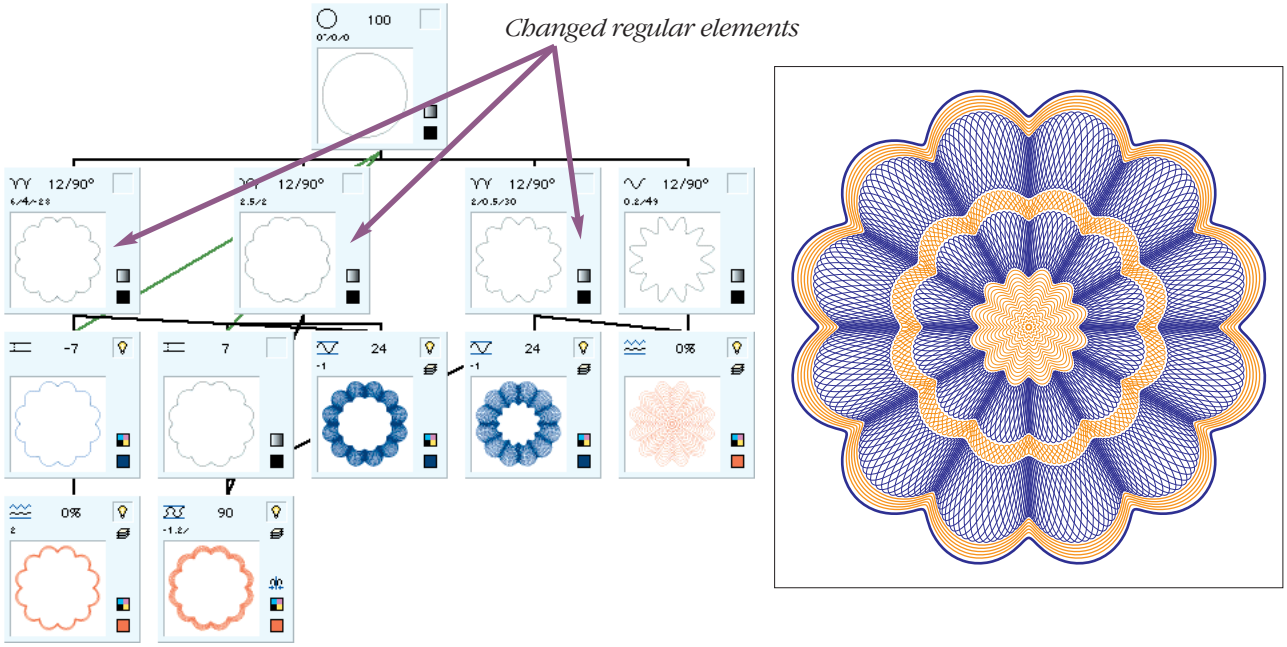


Two following pictures let you compare skeleton paths of original template (left) with skeleton paths of this example (right):

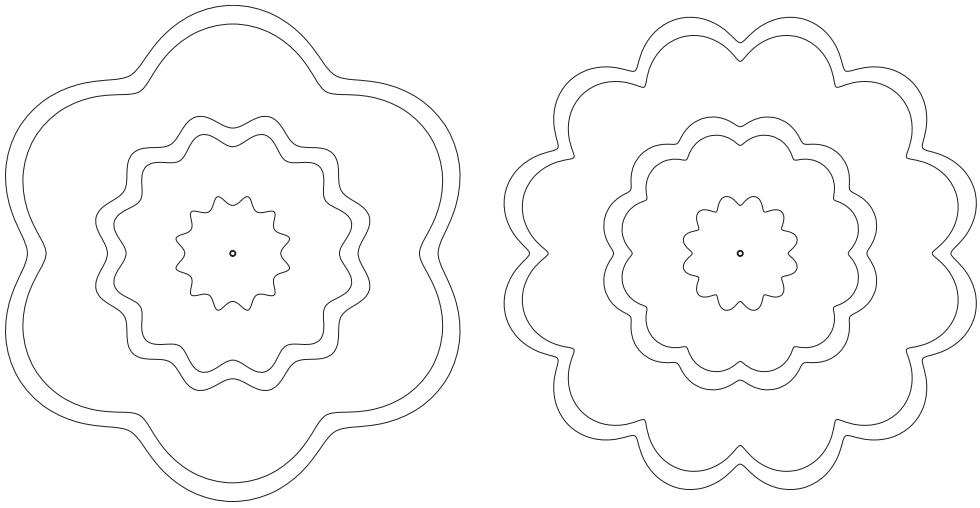


We also increased **Frequency** of the forth content element from '*12*' to '*24*' and reduced number of paths in its Step & Repeat Set from '*12*' to '*8*'. This change makes paths produced by both content elements with blue color (the forth content element and the second content element) of similar 'density'.

◆ **Example 2:** In this example we modified shapes of the first three regular elements to make our rosette design look more like a 'flower'. To achieve this we changed **Type** of all three elements to '*Cycloid*'. The first element now has following attributes: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*6 pt*', **Side Size** = '*4 pt*', **Base Offset** = '*–28 pt*'. The second element: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*2.5 pt*', **Side Size** = '*2 pt*'. The third element: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*2 pt*', **Side Size** = '*0.5 pt*', **Base Offset** = '*30 pt*':

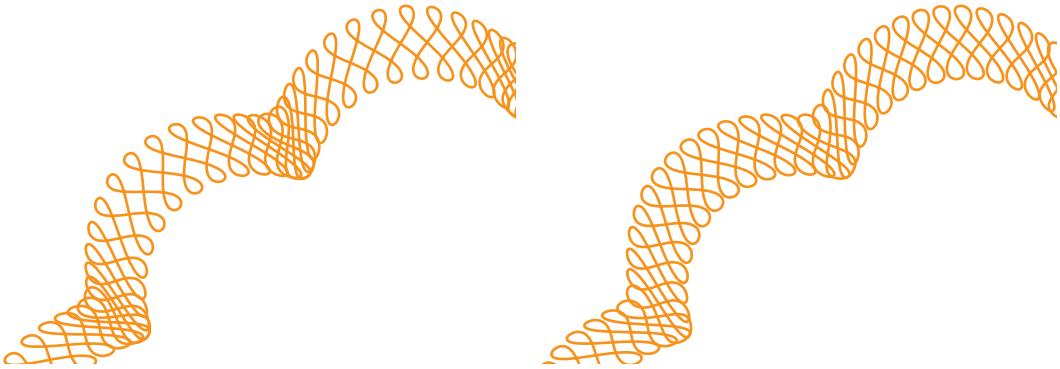


Two following pictures let you compare skeleton paths of original template (left) with skeleton paths of this example (right):

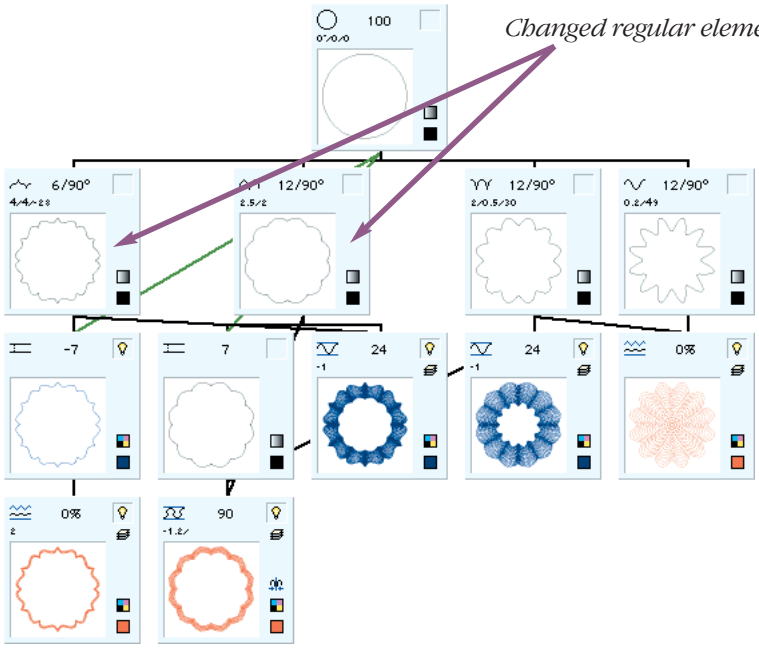


Just like we did in previous example, we increased **Frequency** of the forth content element from '*12*' to '*24*' and reduced number of paths in its Step & Repeat Set from '*12*' to '*8*'.

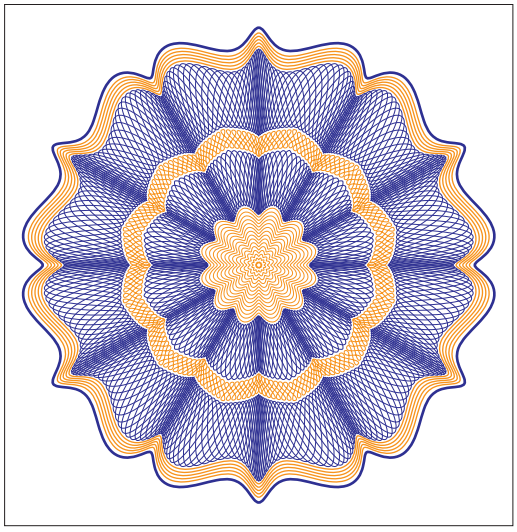
We also added **Frequency Modulation** effect to the second content element with attributes: **Periods** = '*12*', **Phase** = '*0°*', **Amount** = '*–30*'. This change makes paths 'density' more uniform: without areas with 'too thick' and 'too thin' paths coverage. Next two pictures (on the following page) shows paths of this element before (left) and after (right) **Frequency Modulation** effect was applied:



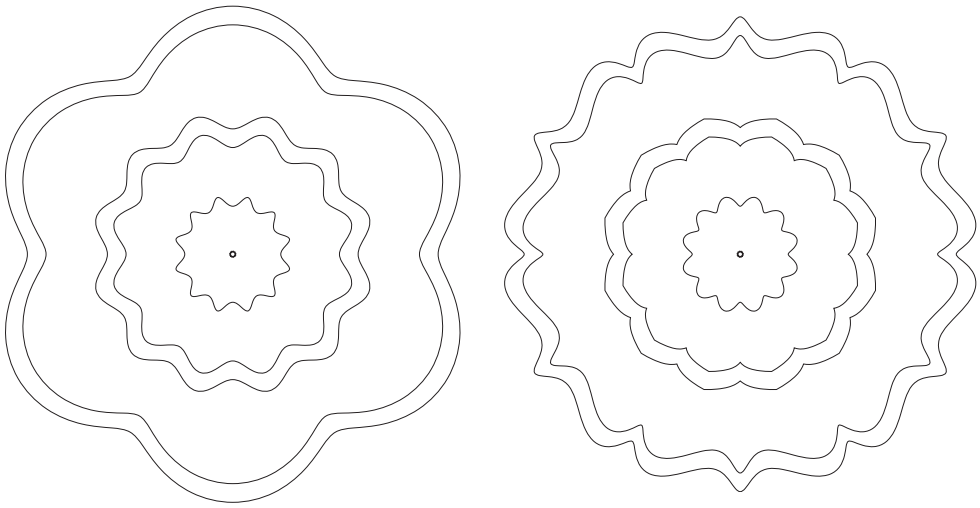
◆ **Example 3:** This example is a further modification of **Example 2**. This time we changed **Type** of the first regular element to '*Brace*' and **Type** of the second regular element to '*Spade*'. The first element now has following attributes: **Frequency** = '*6*', **Phase** = '*90°*', **Amplitude** = '*4 pt*', **Side Size** = '*4 pt*', **Base Offset** = '*–28 pt*'. Attributes of the second element remained the same as in **Example 2**:



*Changed regular elements (comparing to **Example 2**)*

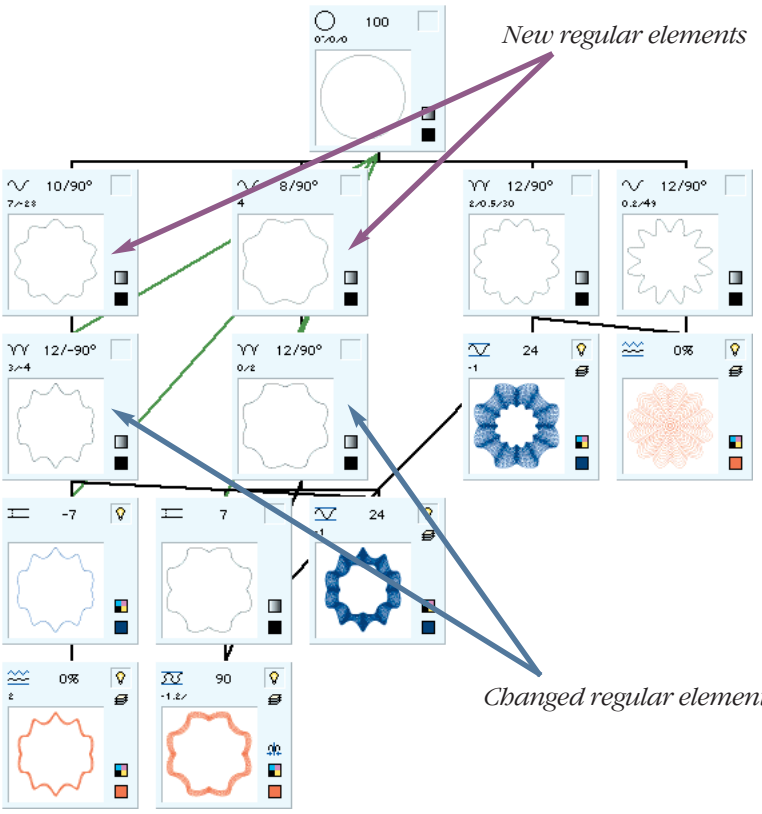


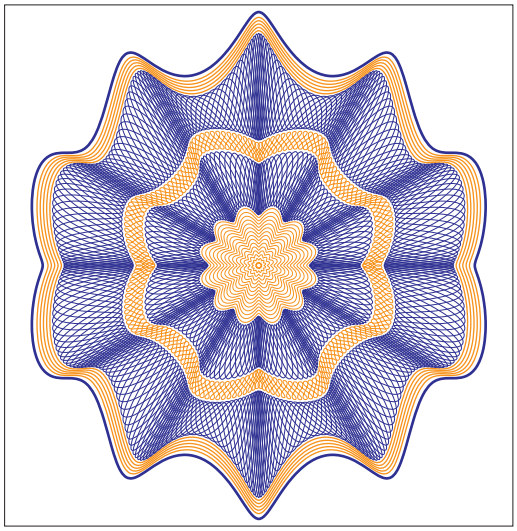
Two following pictures let you compare skeleton paths of original template (left) with skeleton paths of this example (right):



◆ **Example 4:** In this example we tried to make shape of the 'skeleton paths' more complex and less symmetric than before. For this purpose we inserted two new regular elements between **Ellipse** base object and first two regular elements of rosette 'skeleton'. Both new elements have '*Sine Wave*' **Type** and following attributes: the first element — **Frequency** = '*10*', **Phase** = '*90°*', **Amplitude** = '*7 pt*', **Base Offset** = '*–28 pt*'; the second new element — **Frequency** = '*8*', **Phase** = '*90°*', **Amplitude** = '*4 pt*'.

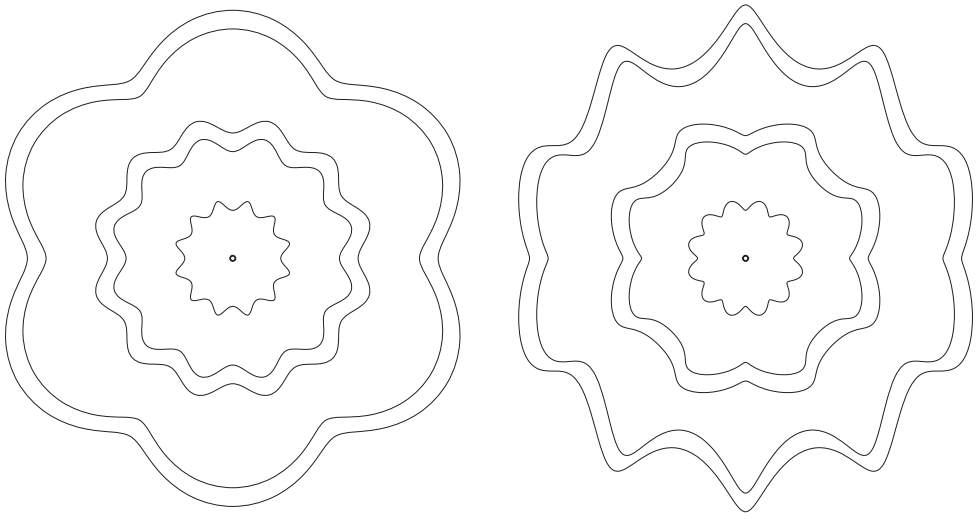
Attributes of the first 'skeleton' regular element are changed to **Frequency** = '*12*', **Phase** = '*–90°*', **Amplitude** = '*3 pt*', **Side Size** = '*–4 pt*', **Base Offset** = '*0 pt*'. Attributes of the second 'skeleton' element are changed to **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*0 pt*', **Side Size** = '*2 pt*'. **Ellipse** base object is set as **Direction** object for these elements:





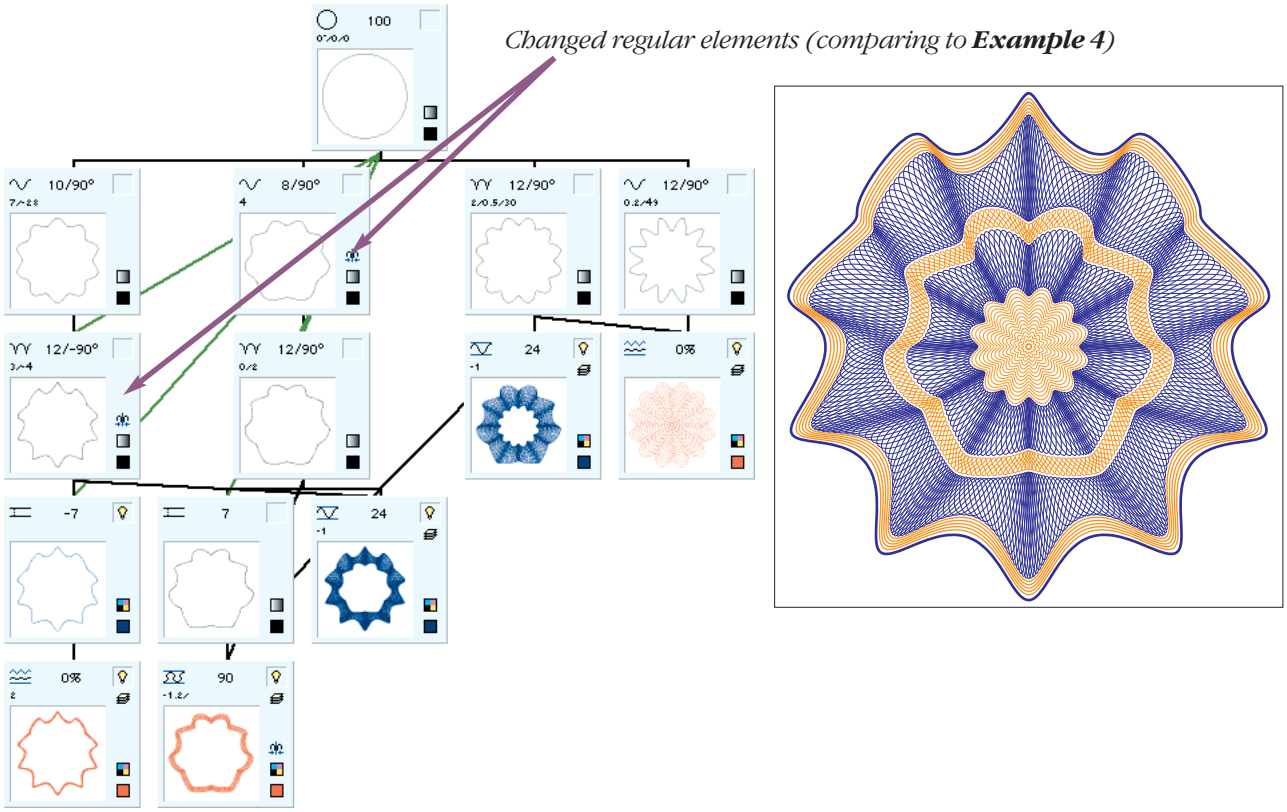
Changed regular elements of rosette 'skeleton'

Skeleton paths of original template (left) and skeleton paths of this example (right):

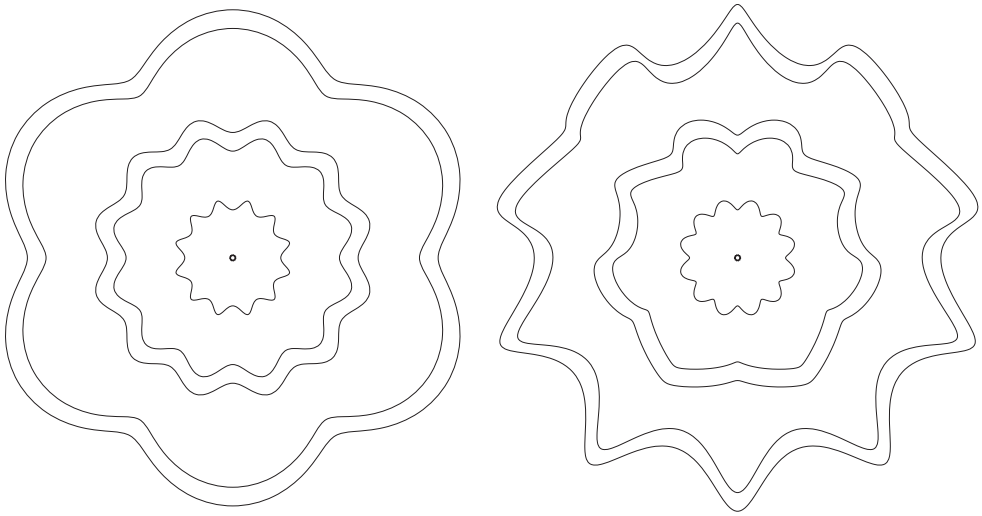


◆ **Example 5:** In this example we added **Frequency Modulation** effects to two regular elements of **Example 4**. Both **Frequency Modulation** effects have similar attributes: **Periods** = '*1*', **Phase** = '*90°*' (the area of higher **Frequency** is located in top part of the rosette, the area of lower **Frequency** — in bottom part of the rosette), **Amount** = '*2*'.

This change makes 'skeleton paths' even more complex and less symmetric, so that our rosette starts looking like a seashell:



Two following pictures let you compare skeleton paths of original template (left) with skeleton paths of this example (right):

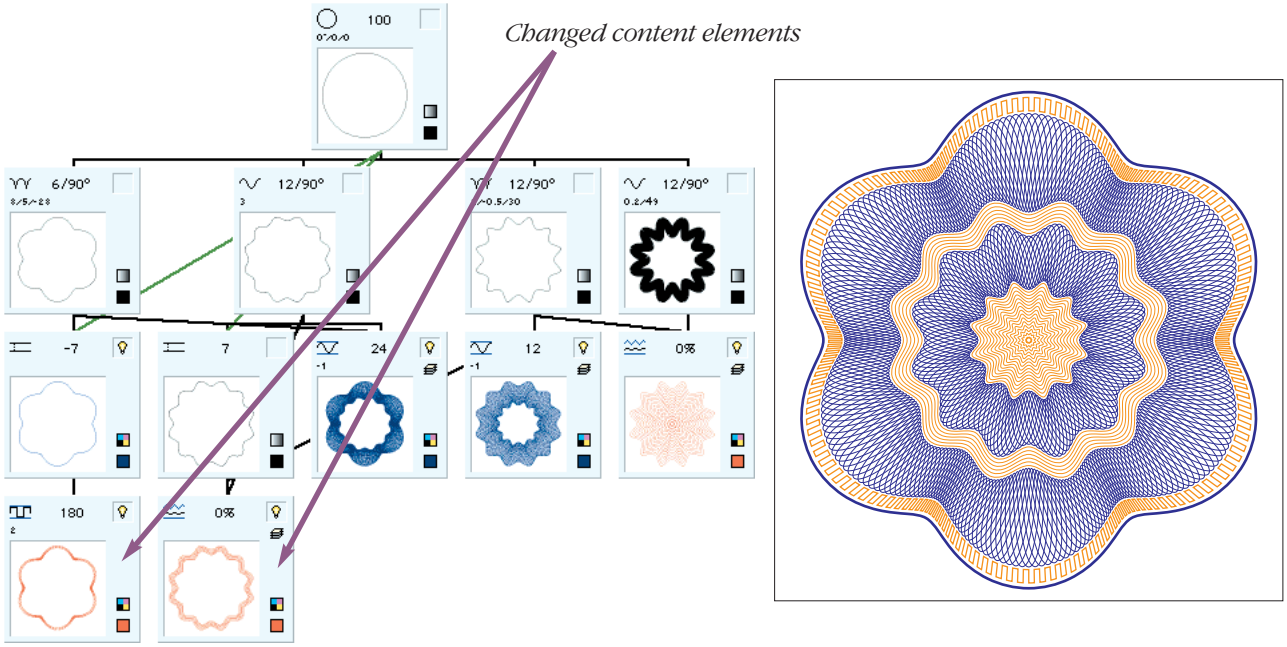


■ **Rosette Content Variations.** Next four examples show variations of rosette 'vector texture' formed by its content elements. We will start with changing attributes of the the first two content elements that form thin band-like patterns of orange color (**Example 6**, **Example 7** and **Example 8**). The regular elements and 'skeleton bones' of the rosette will remain the same in these examples as in original template file. After that we will show effect of all content elements intersecting each other (**Example 9**):

◆ **Example 6:** In this example we modified attributes of the first two content elements that form thin band-like patterns of orange color.

Type of the first content element is changed to '*Notch*', its **Frequency** attribute is set to '*180*', Step & Repeat Set is removed. To make path of this element 'closed' with start and end points meeting each other switch to **Path** panel of **Excentro Control** inspector and choose '*Yes*' from **Closed** pop-up menu.

Type of the second content element is changed to '*Blend*', **Auto** checkbox is switched on beside **Ratio** attribute field in Step & Repeat Set area to allow automatic calculation of this attribute value. Number of steps in this Step & Repeat Set is set to '*6*'.

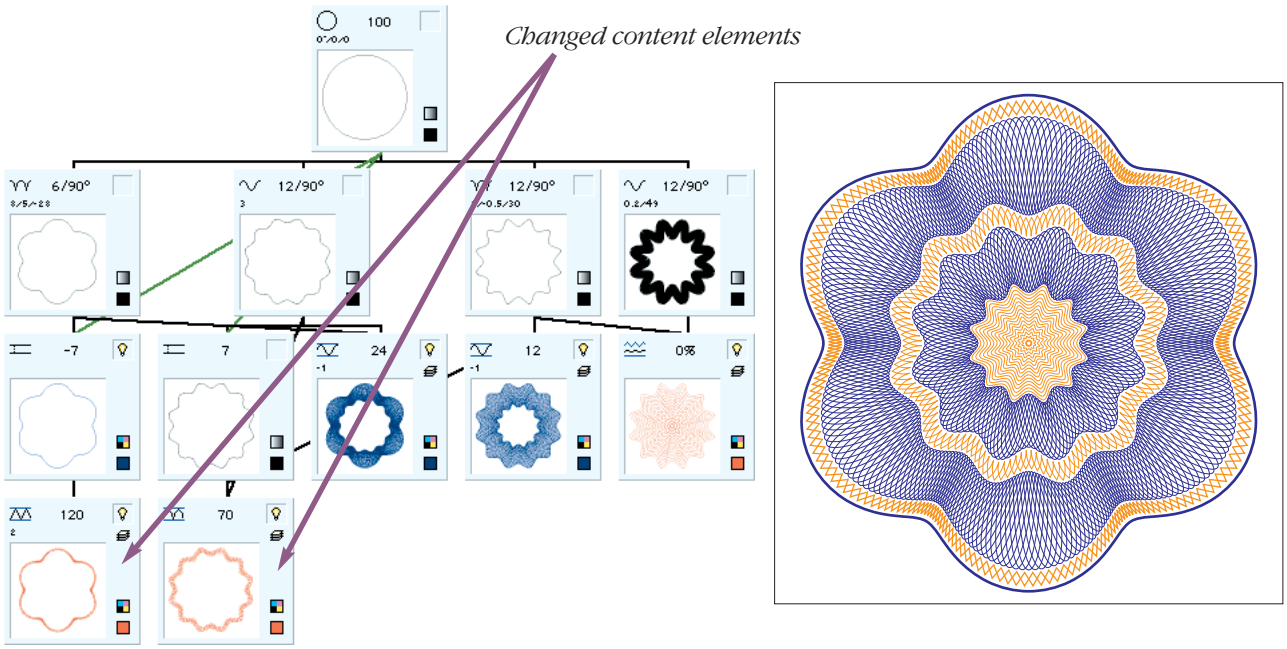


◆ **Example 7:** This example shows another variation of the first two content elements (that form thin band-like patterns of orange color).

Type of the first content element is changed to '*Star*', its **Frequency** attribute is set to '*120*'. Number of steps in this Step & Repeat Set is set to '*2*' and **Auto** checkbox is switched on beside **Phase** attribute field of Step & Repeat Set to allow automatic calculation of this value.

Type of the second content element is changed to '*Spade*', **Frequency** attribute is set to '*70*', **Side Size** attribute is set to '*0.5 pt*'. Number of steps in this Step & Repeat Set is also set to '*2*' and **Auto** checkbox is beside **Phase** attribute field of Step & Repeat Set is also switched on.

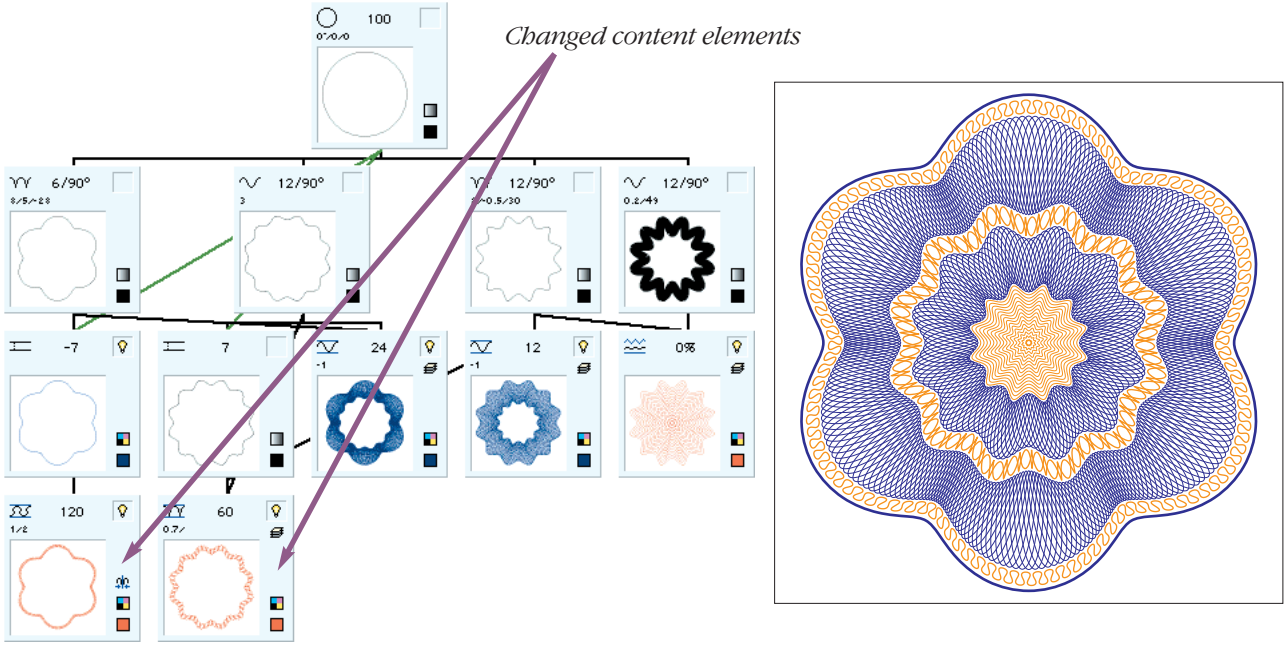
See illustration of this example on following page.



◆ **Example 8:** This example is the last variation of attributes of the first two content elements (thin band-like patterns of orange color).

Type of the first content element is changed to '*Eight*', **Frequency** attribute is set to '*120*', **Side Size** attribute is set to '*1 pt*', Step & Repeat Set is removed. We added **Frequency Modulation** effect to this element with attributes: **Periods** = '*6*', **Phase** = '*0°*', **Amount** = '*–50*'. This change makes paths 'density' more uniform.

Type of the second content element is changed to '*Cycloid*', **Frequency** attribute is set to '*60*', **Side Size** attribute is set to '*0.7 pt*'. **Side Size** attribute in Step & Repeat Set area is set to '*–1.4 pt*'. This makes the second path of Step & Repeat Set to have **Side Size** value of '*–0.7 pt*', it is the opposite value to attribute of original path.

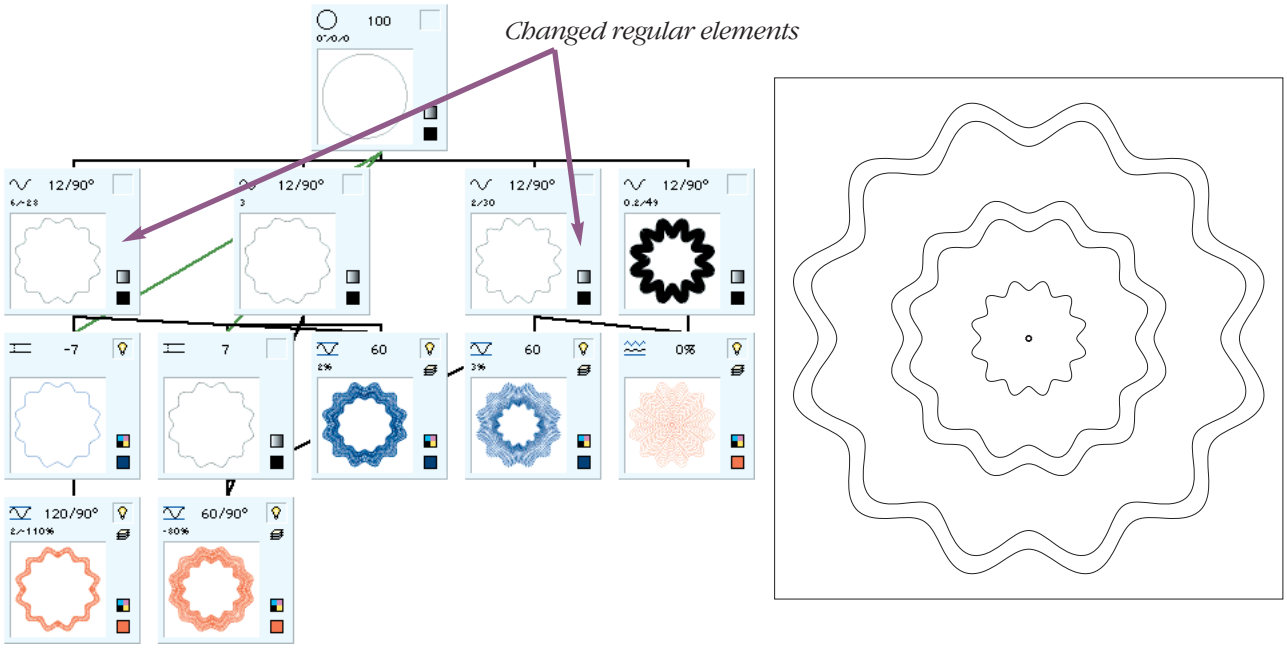


Example 6, **Example 7** and **Example 8** show most typical cases of content elements variation used in rosette designs. Different variations of content elements **Type** look best in thin band-like areas with no Step & Repeat Sets or with Step & Repeat Sets with small number of steps (2 or 3 paths).

For wider bands (like the one of blue color in our template example) we suggest to use more simple and common **Sine Wave** type content elements with high **Frequency** attribute value and large number of paths in Step & Repeat Sets (4 and more paths). This way paths intersections produce most pleasant effect. Using content elements of other types for wide bands would produce too complex intersection areas with very high or very low paths 'density'.

◆ **Example 9:** This example shows effect of content elements paths intersecting each other. To make this example more educational we changed attributes of two regular elements that form rosette 'skeleton'. This makes external and internal areas of the rosette have similar sine wave shapes.

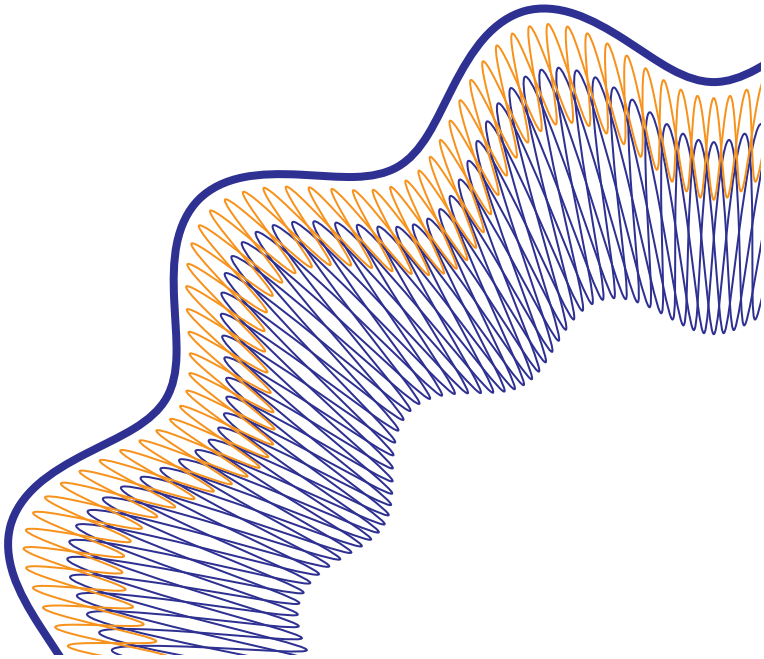
Type of all regular elements is set to '*Sine Wave*'. The first element now has following attributes: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*6 pt*', **Base Offset** = '*–28 pt*'. The third element: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*2 pt*', **Base Offset** = '*30 pt*':



Type of the first four content elements is set to '*Sine Wave*'. The first content element has attributes: **Frequency** = '*120*', **Phase** = '*90°*', **First Base Offset** = '*2 pt*' with **Distance with Base Direction** option, **Second Base Offset** = '*–110%*', number of paths in Step & Repeat Set = '*2*'.

Large negative value of **Second Base Offset** attribute makes paths of the first content element intersect paths of the third content element (the blue ones) that has attributes: **Frequency** = '*60*', **Phase** = '*0°*', **First Base Offset** (and **Second Base Offset**) = '*2%*', number of paths in Step & Repeat Set = '*4*'.

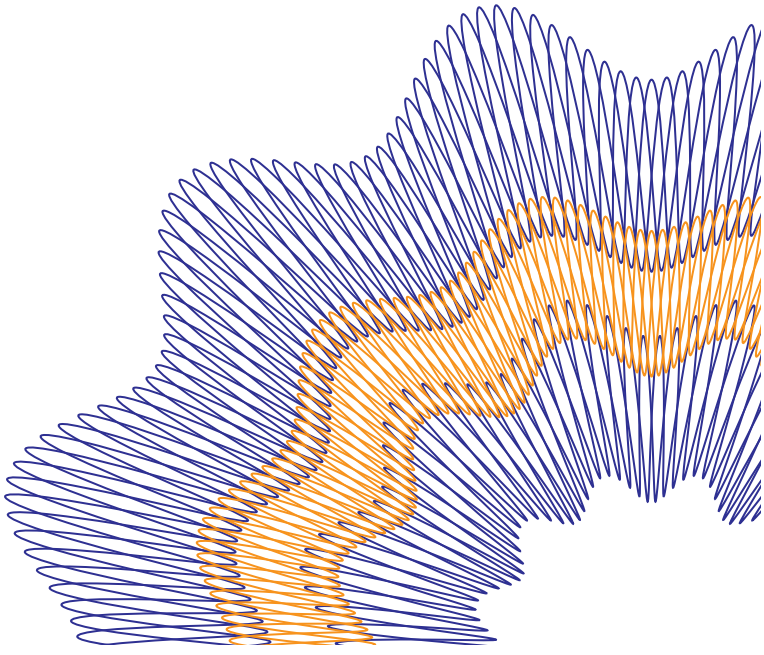
Illustration on next page shows enlarged area of these paths intersection.



Note that **Frequency** attribute of the first element (120) is twice as high as that of the third element (60), but number of paths in its Step & Repeat Set (2) is twice as low as that of the third element (4). As a result these elements have similar 'relative paths density' and their intersection area form regular pattern.

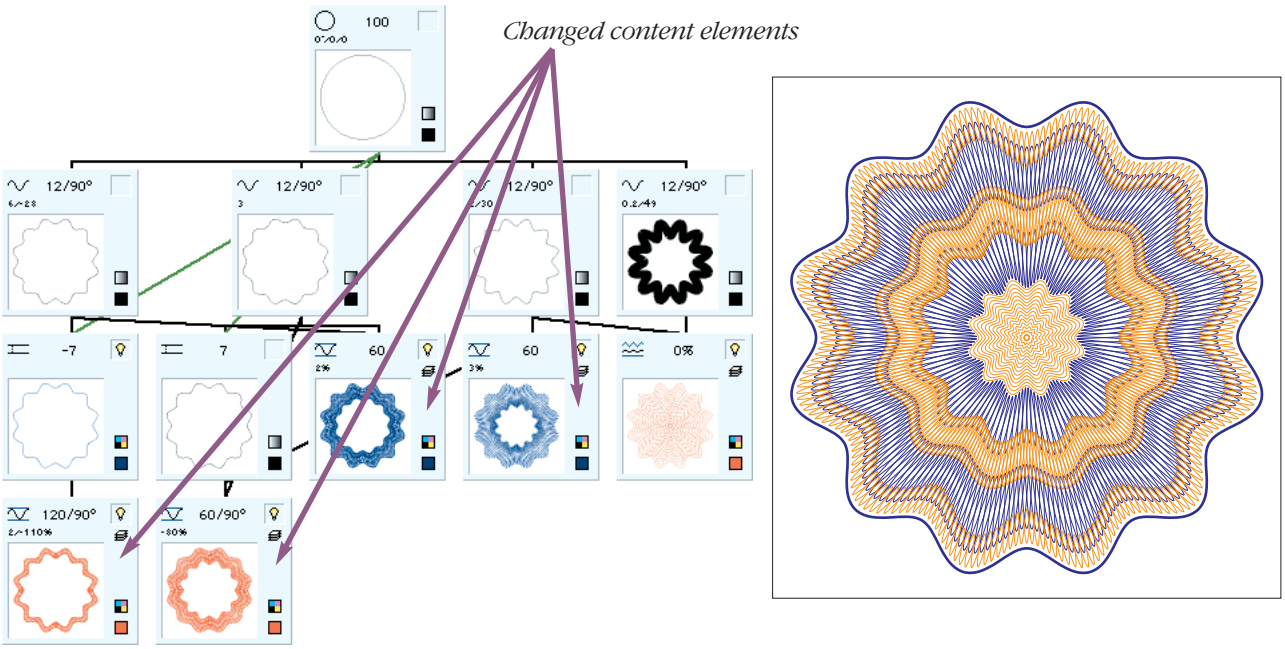
The second content element (with orange paths) has attributes: **Frequency** = '*60*', **Phase** = '*90°*', **First Base Offset** (and **Second Base Offset**) = '*–80%*', number of paths in Step & Repeat Set = '*4*'. As with the first content element, large negative values of **First Base Offset** and **Second Base Offset** attributes make paths of this content element intersect paths of the third content element and the fourth content element (both have blue colored paths).

The fourth content element has attributes: **Frequency** = '*60*', **Phase** = '*0°*', **First Base Offset** (and **Second Base Offset**) = '*3%*', number of paths in Step & Repeat Set = '*2*'. Illustration below shows enlarged intersection area of the second, the third an the fourth content elements paths:

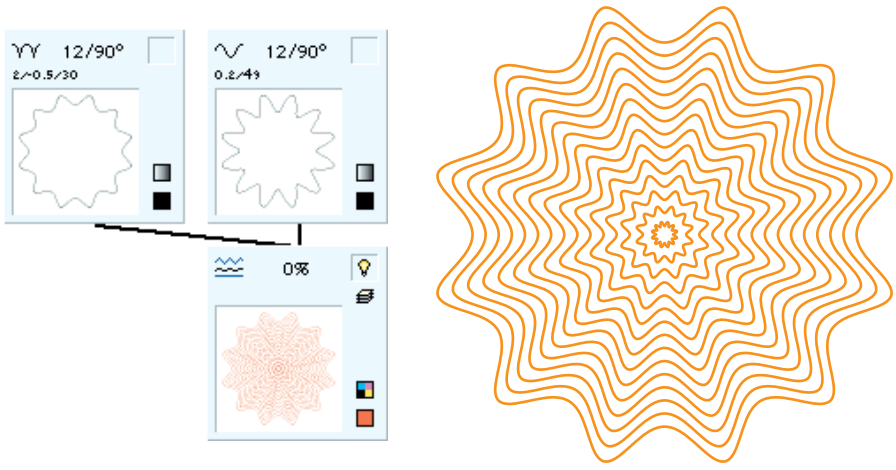


As before, please, note that **Frequency** attributes (60) and number of paths in Step & Repeat Sets (4) of the second and the third content elements are the same, so they have similar 'relative paths density' and their intersection area form regular pattern. Number of paths in Step & Repeat Set of the fourth content element is two time lower (2) because it is much closer to the rosette center. Intersection area of the third and the fourth content elements still form regular pattern but this time the pattern is different.

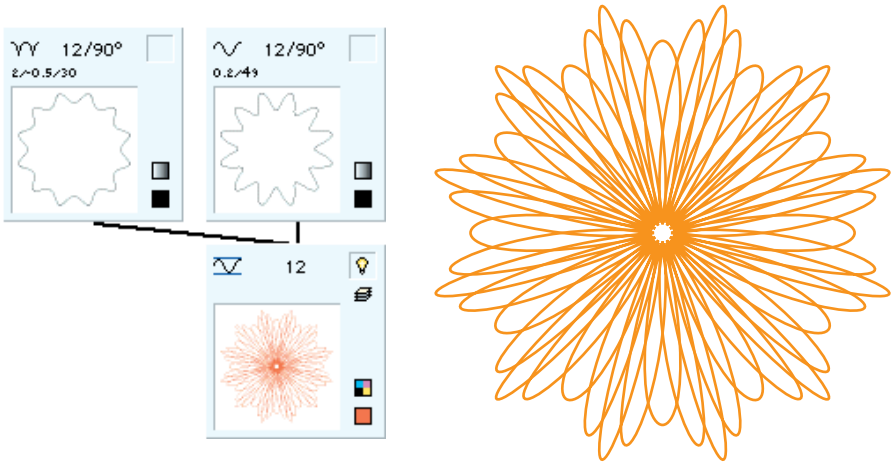
Below is the picture of this example rosette design:



■ **Rosette Central Part Variations.** Last three examples built on **Rosette Template 1.exc** template show variations of rosette central area. This area in original template file consists of two regular elements (the third and the fourth regular elements of rosette 'skeleton') and one content element of **Blend** type with Step & Repeat Set that 'fills space' between paths of these regular elements. Pictures below show these three elements and enlarged illustration of the rosette center:



If we will try to modify central part of the rosette by changing type of the content element, for example, changing it to **Sine Wave**, we are in risk to make density of paths in the center to high. That will turn into problems or defects at print time when adjacent paths merge together and form single ink filed area, as shown on picture below:

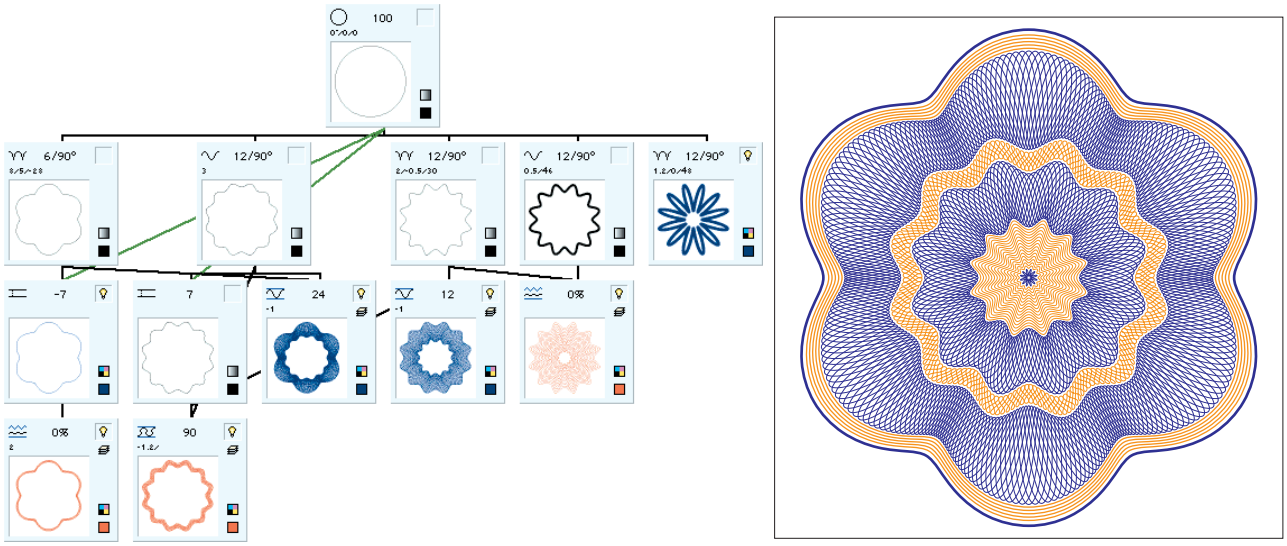


It might be unfair, but practice shows that **Blend** is the only type of content elements that could be used in very center of rosette design.

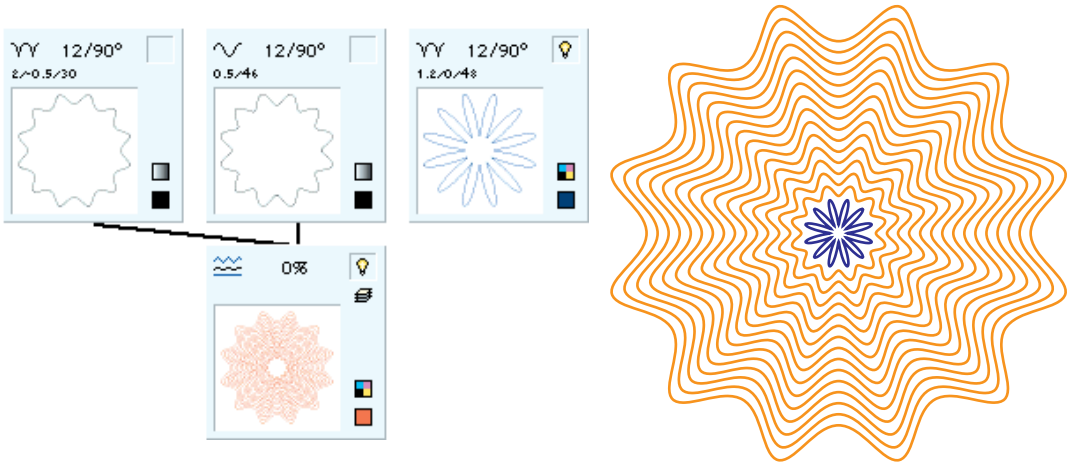
Another option for the rosette central area would be to create additional regular element and place it right in the rosette center. Path of this element will form central pattern of the rosette and this element will not have any connections to other content and regular elements. Three examples below illustrate this case. In all of them the fifth regular element is added to the rosette design. The path of the forth regular element is made a bit wider and the content element constructed between it and the third regular element no longer present 'paths merging' problem mentioned above. It is no longer different from other content elements of this rosette. Now we are free to change type of this content element to **Sine Wave** or whatever.

◆ **Example 10:** In this example we added the fifth regular element to the rosette of our original template file. **Type** of this element is set to '*Cycloid*', its attributes: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*1.2 pt*', **Side Size** = '*0 pt*', **Base Offset** = '*48 pt*'. The path of this element now occupies the center of the design. This path is 'visible' and has the same blue color as two content elements.

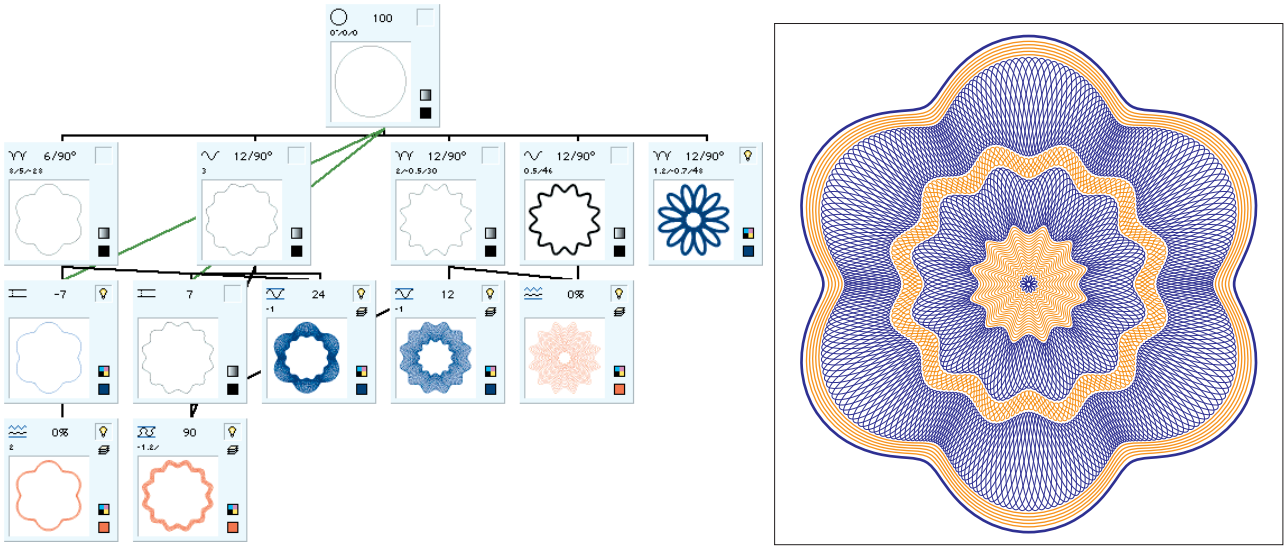
Two attributes of the forth regular element were changed to move its path away from the rosette center: **Amplitude** = '*0.5 pt*', **Base Offset** = '*46 pt*'



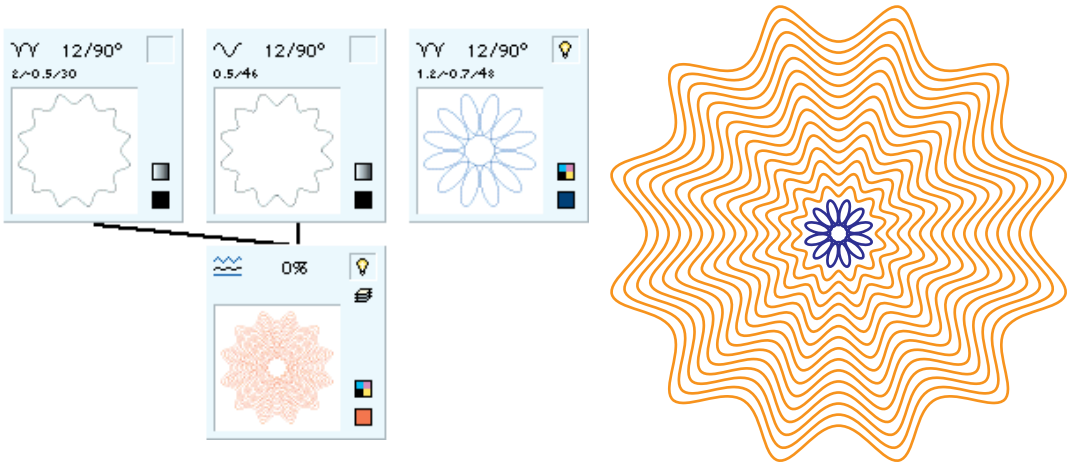
Pictures below show four elements that form the rosette center and enlarged illustration of the central area:



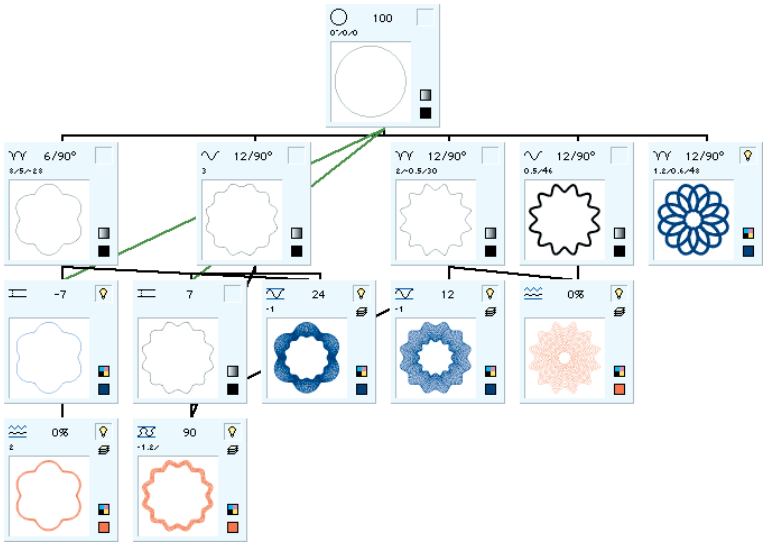
◆ **Example 11:** In this example we changed the fifth regular element of **Example 10**. We modified **Side Size** attribute of the **Cycloid** to make it look like a flower: **Side Size** = '*–0.7 pt*'.

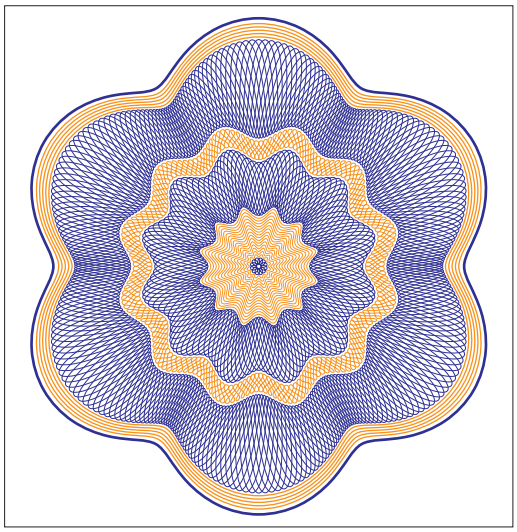


The four elements of rosette center and enlarged illustration of this area:

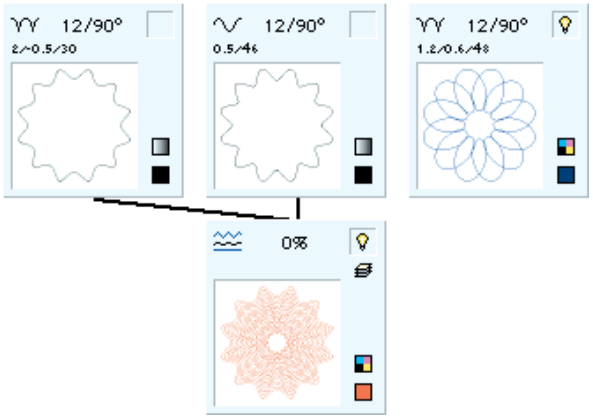


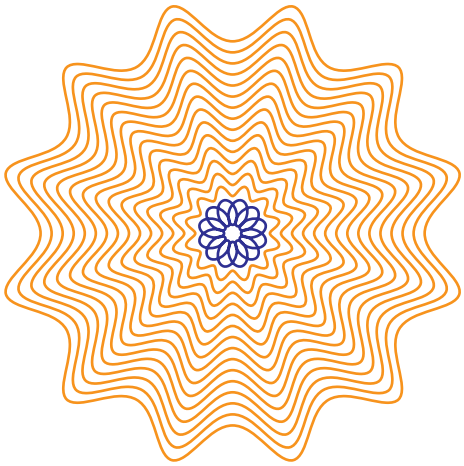
◆ **Example 12:** Another modification of the fifth regular element. This time we set **Side Size** attribute of the **Cycloid** to positive value of '*0.6 pt*'.





The four elements of rosette center and enlarged illustration of this area:





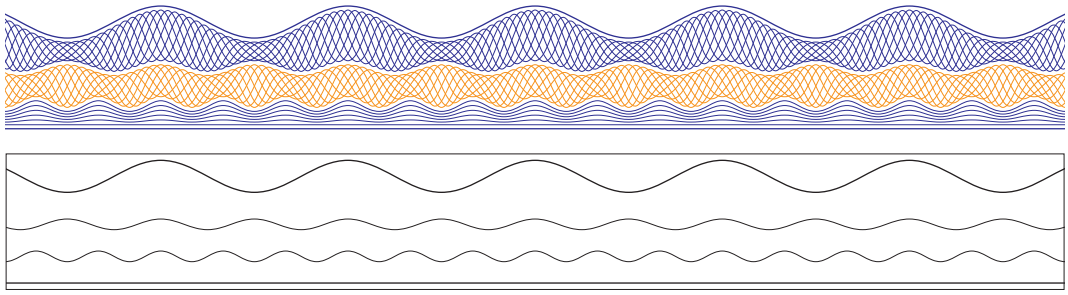
CHAPTER 7: BORDERS

This chapter explains how you can use *Excentro* to create borders — linear guilloche designs that usually occupy border areas of certificate or diploma. Example we will construct in this chapter is the same as that of stationary file '**Border Template 1.exc**' from '**Excentro Templates**' folder. You can use this template to create new border designs by modifying attributes of its objects without a need to reconstruct them in new file following all steps described below.

CASE STUDY

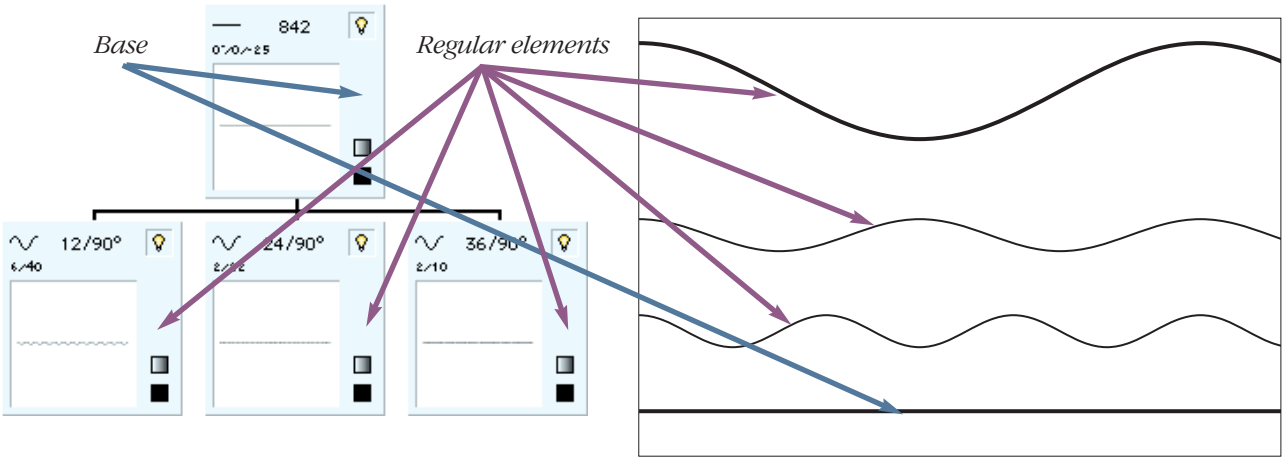
If you have already read the previous chapter, you can regard classic border designs as 'flat' or linear rosettes. The border construction process follows almost the same steps as the ones described in **Rosettes** chapter of this book. The main difference between borders and rosettes is that borders are linear and use base objects of **Line** type instead of circular **Ellipse** bases.

Just like with rosettes, borders also consist of sets of interlacing paths that fill area between several 'skeleton' paths. The first picture below shows finished border design while the second picture shows only wavy paths that form its skeleton. Some 'skeleton' paths are frequently made invisible at the end of the construction process:



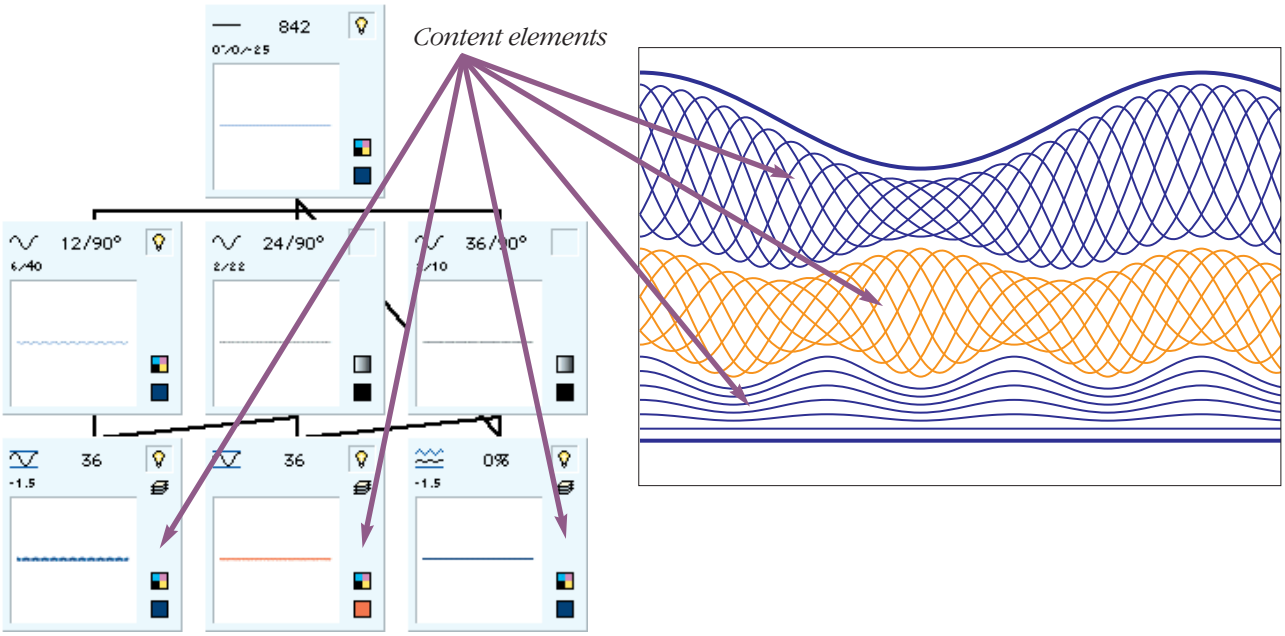
As was mentioned above, border designs are linear and to create them we should start with base object of **Line** type. **Length** attribute of this object should be set to desired extent of the border. **Line** base will be used as a parent object for several regular elements that form 'skeleton' paths. These paths control shape of different border areas: top part, one or more middle parts and bottom part. The path of **Line** base object itself is often used as the bottom 'skeleton' path of the design.

Picture below shows guilloche structure with **Line** base object and three regular elements of the skeleton:



When the 'skeleton' paths of the design are ready we should add content elements with Step & Repeat Sets between them. Step & Repeat Sets should modify **Phase** attribute of content elements to achieve effect of uniform vector texture, or in case of **Blend** content elements Step & Repeat Set should modify their **Ratio** attribute (**Blend** content element is used in bottom area of our border example).

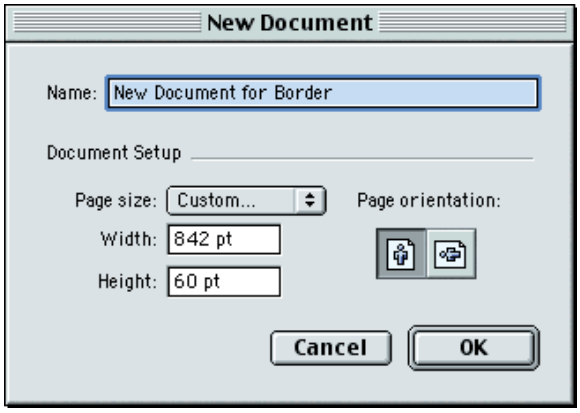
As the last step we should switch off visibility of some 'skeleton' paths that are not needed in finished design. Guilloche structure of finished border is shown on the following picture:



STEP BY STEP BORDER CREATION

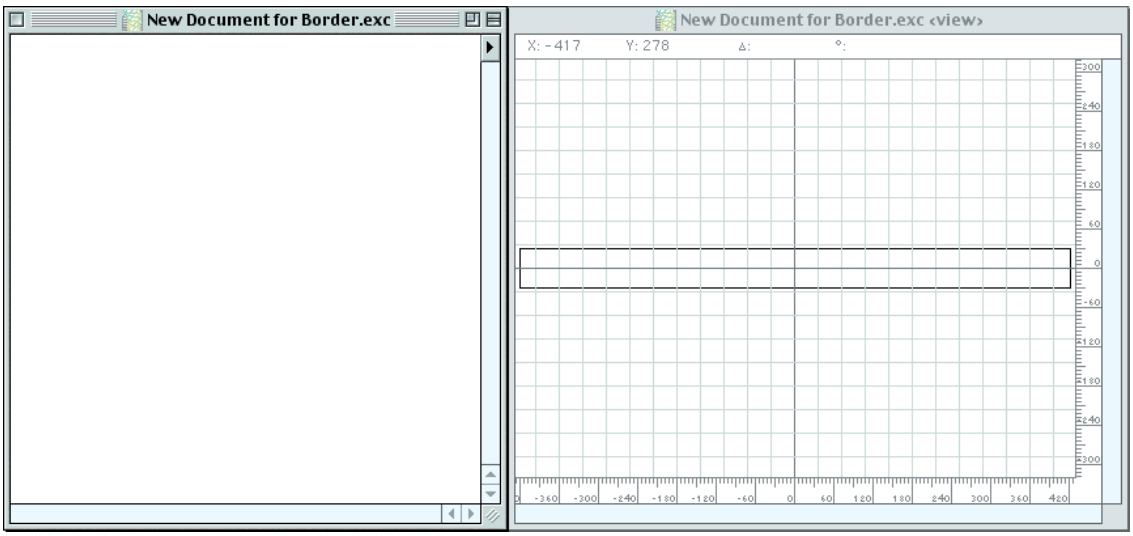
In this section you can find detailed description of all steps required to create typical border.

■ **Step 1: New Document.** Choose **New** command from **File** menu. **New Document** dialog will appear. Select proper predefined document size from pop-up menu or enter custom document dimensions.



You can either use some standard document size if this border will be a part of some certificate of similar size, this way it will be easier to judge border dimensions comparing to other parts of whole design (you can even create the border at a new layer of existing document with ready background and rosettes), or you can use custom document size that will be just enough to accommodate only this border, this will simplify preview and scrolling at high magnification values.

In our example we will create border with length equal to the long side of A4 certificate and height about 0.7 inches (1.7 cm), so let us start with a document of custom size 842x60 pt. Click **OK** button and two windows of new document will appear in front of you:



■ **Step 2: Line Base Object.** As the root object for our border design we will use base object of **Line** type. We will set length of this line to the same value as the document width. This line will be positioned in the bottom part of the document.

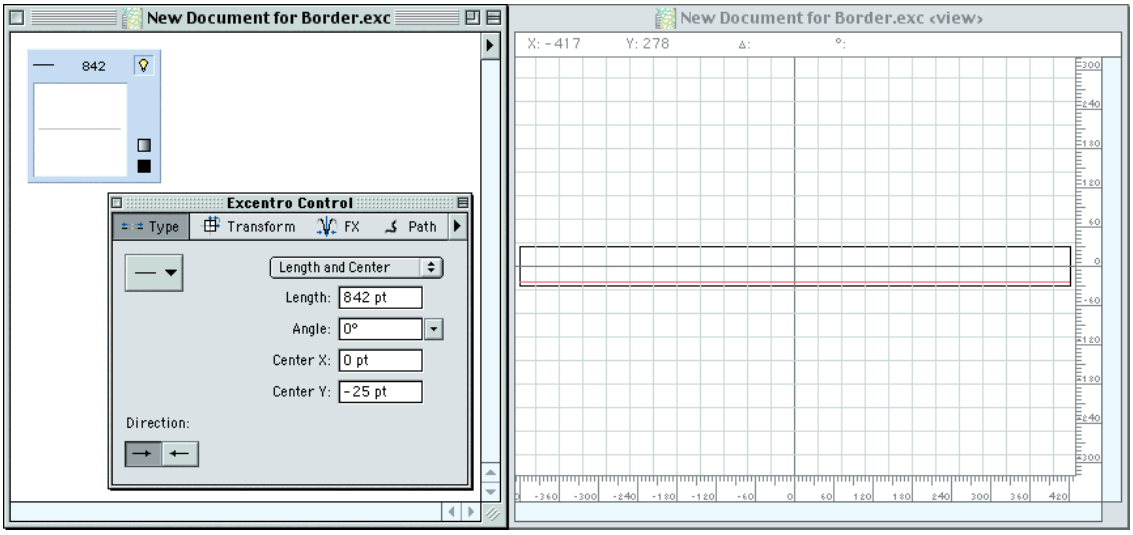
Choose **New Base** command from **Structure** menu to create new base object. After that in **Excentro Control** inspector choose following options:

- '*Line*' from **Type** pop-up menu
- '*Length and Center*' from Line options pop-up (it will be easier to control length of the line in case we will need to change document size later)

Enter following attributes in appropriate fields of **Excentro Control** inspector:

- **Length** = '*842 pt*' (full document width)
- **Angle** = '*0°*' (our line should be horizontal)
- **Center X** = '*0 pt*' (horizontal center of the document)
- **Center Y** = '*–25 pt*' (bottom position in the document)

Base creation is finished, you should get following picture on your screen (preview of the base line is shown with red in document preview window because it is the selected object):



■ **Step 3: 'Skeleton' Regular Elements.** Now we will create regular elements that produce paths that form wireframe skeleton of our border design. These elements will control shape of the border, you will need to modify attributes only of these elements to change height or shape of top, middle and bottom parts of the border. By modifying types and attributes of these elements you can make these parts more wavy in shape or, for example, start-like.

Let us start with the top 'skeleton' path, and then create other 'skeleton' paths one after another.

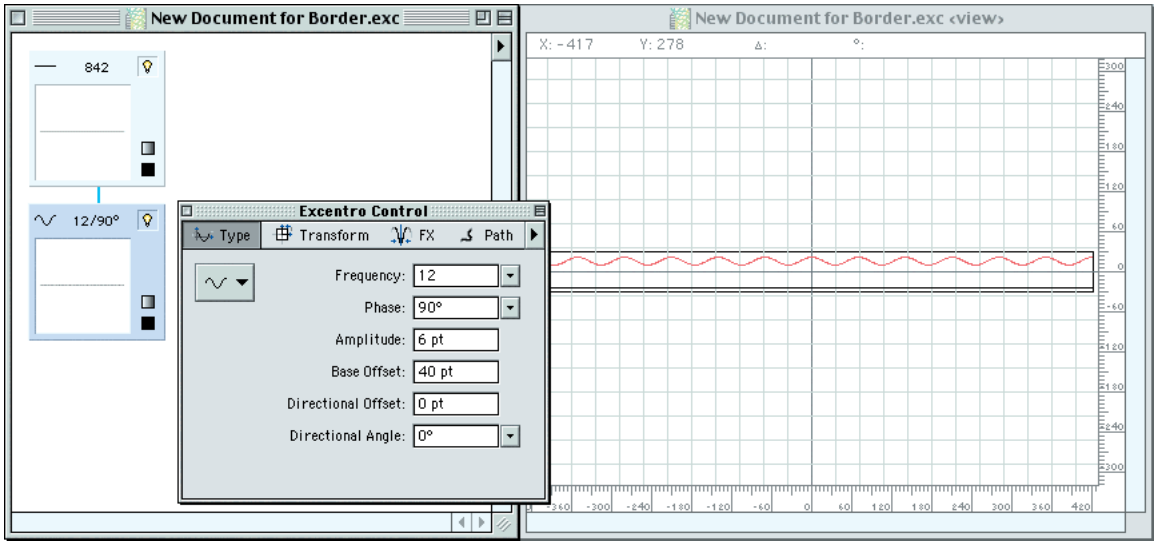
First Element: Select the base object we created in step above with mouse click, choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Frequency** = '*12*' (this path should not have too many 'waves')
- **Phase** = '*90°*' (the path will begin with 'top' point of the wave)
- **Amplitude** = '*6 pt*' (the path should have visible waves but not very high)
- **Base Offset** = '*40 pt*' (this will offset path by 40 points from line base path)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The first 'skeleton' regular element is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):



Second Element: You can create the second element by duplicating the first one and modifying its attributes, or you can create completely new element like we will do.

Select the base object with mouse click and choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

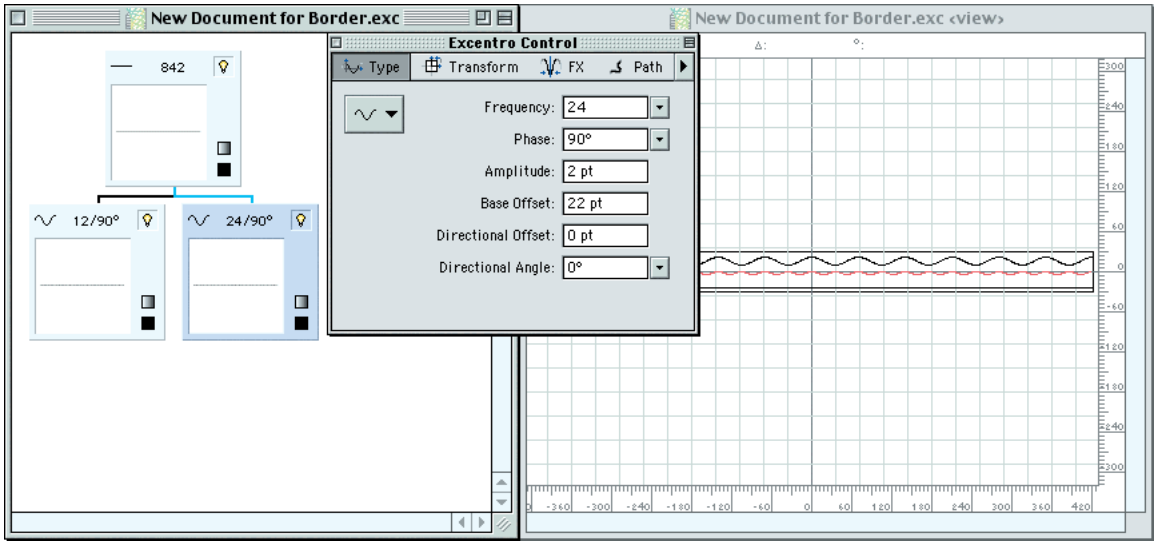
- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Frequency** = '*24*' (this path will have more 'waves' than the first one)
- **Phase** = '*90°*' (the path will begin with 'top' point of the wave)
- **Amplitude** = '*2 pt*' (let us make waves of this path slightly lower)

- **Base Offset** = '*22 pt*' (this will set this path closer to the base)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The second 'skeleton' regular element is ready, you should get following picture on your screen (preview of the path is shown with red because it is selected):



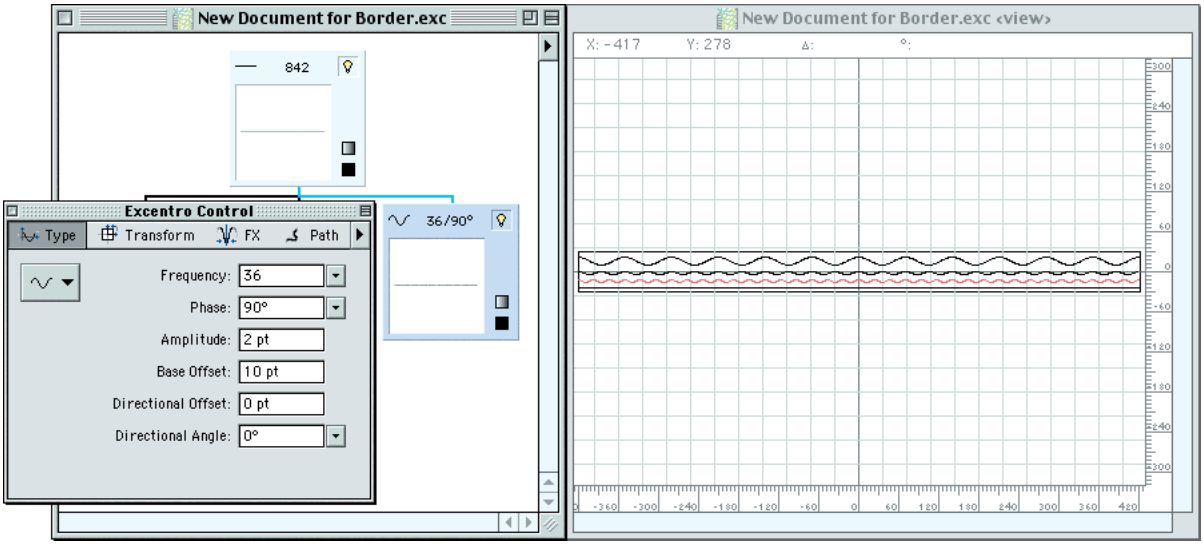
Third Element: Select the base object with mouse click and choose **New Element** command from **Structure** menu to create new regular element object. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Frequency** = '*36*' (this path will have even more 'waves')
- **Phase** = '*90°*' (the path will begin with 'top' point of the wave)
- **Amplitude** = '*2 pt*' (the same value as the second element)
- **Base Offset** = '*10 pt*' (this will set this path even closer to the base)
- **Directional Offset** = '*0 pt*' (default initial value)
- **Directional Angle** = '*0°*' (default initial value)

The third 'skeleton' regular element is ready:



■ **Step 4: Content Elements.** In **Step 3** we created all 'skeleton' paths of our border design. Now we will add content elements with Step &Repeat Sets that form 'vector texture' of the border. Just like with regular elements, we will start with top area of the border and then we will create middle and bottom ones one after another.

First Content Element: Select the first regular element with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the second regular element. Rectangular representation of the first clicked element in main document window should become blue (color for the selected object), rectangular representation of the second element should become reddish (color for the second selected object). Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

◆ '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

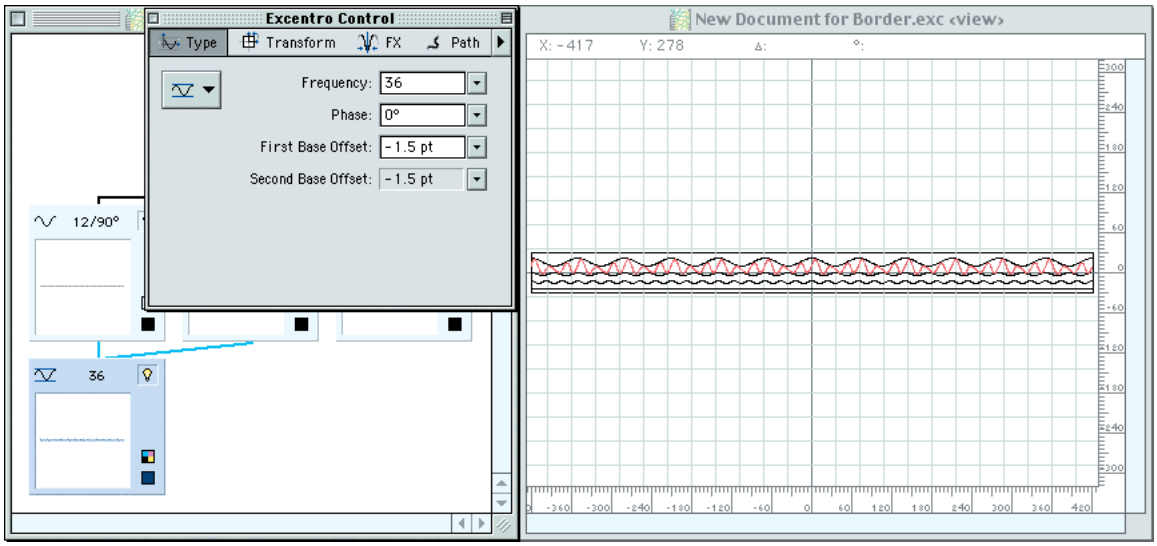
◆ **Frequency** = '*36*' (three times higher than **Frequency** of the first regular element)

◆ **Phase** = '*0°*' (default initial value, no need to change it, Step & Repeat Set will modify this value for other copies of this element's paths)

◆ **First Base Offset** = '*–1.5 pt*' (let us offset this path by 1.5 points from the paths of its parent elements)

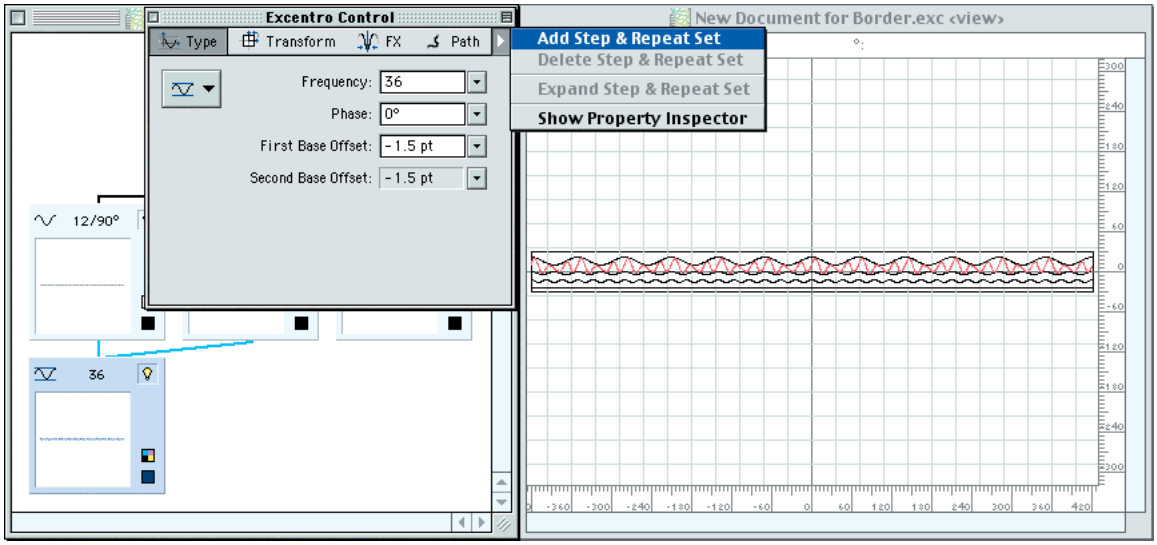
◆ **Second Base Offset** = '*–1.5 pt*' (this value is automatically set by '*Same as First Base Offset*' option in pop-up menu beside this field)

You should get following picture on your screen (preview of content element's path is shown with red because it is selected):



Let us apply stroke and color attributes to the path of this content element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be some blue color) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control** or to rectangular representation of this element in main document window.

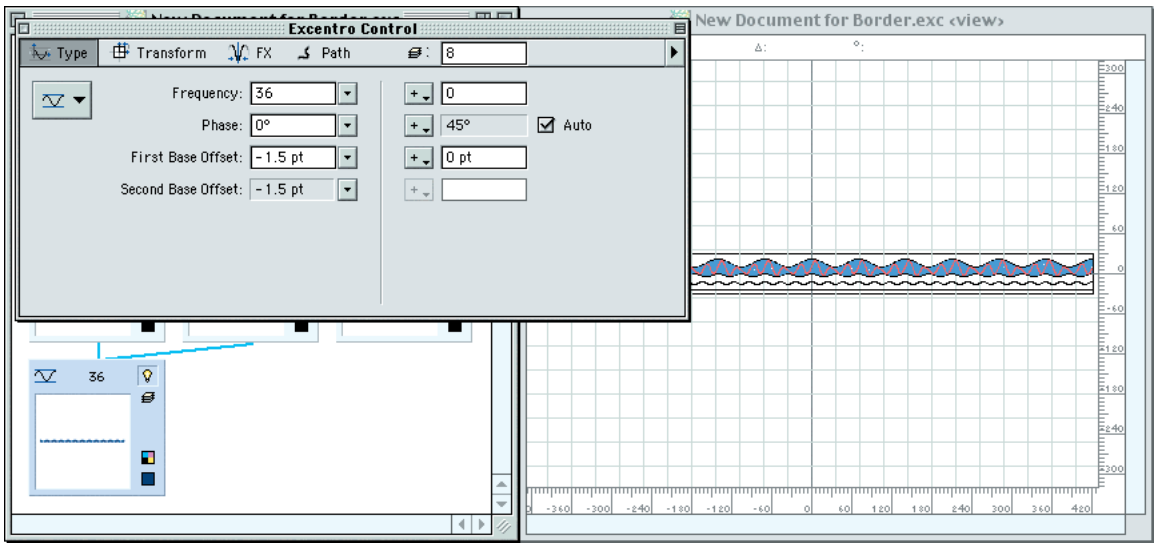
Now we will apply Step & Repeat Set modification to this content element that will create the rest this element paths. Select the content element with mouse click, and choose **Add Step & Repeat Set** command from **Excentro Control** window menu (see picture on next page).



Enter following values in fields of new Step & Repeat Set:

- **Number of Steps** = '*8*' (this will make a set of 8 paths: original path of the content element and 7 additional paths)
- **Phase** — click **Auto** checkbox beside numeric field and **Phase** attribute value will be automatically calculated so that 8 paths of the content element cover whole [0°; 360°] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



Second Content Element: Paths of this content element form vector pattern between paths of the second and the third regular elements we created in **Step 3**. Select the second regular element with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer the third regular element. Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

- '*Sine Wave*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

- **Frequency** = '*36*' (the same value as that of the first content element)
- **Phase** = '*0°*' (default initial value)

◆ **First Base Offset** = '*0 pt*' (default initial value)

◆ **Second Base Offset** = '*0 pt*' (default initial value)

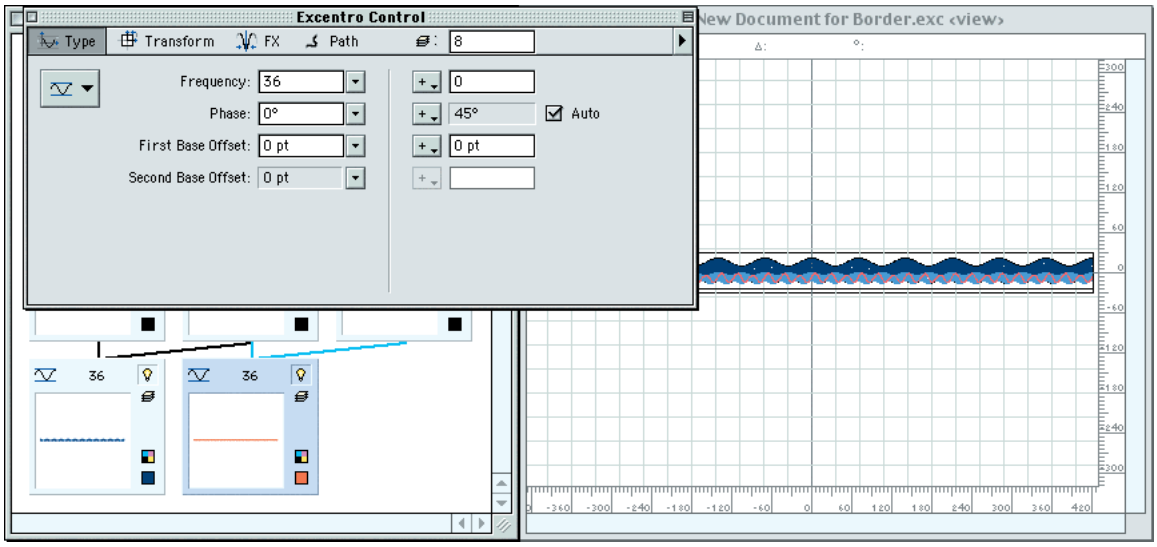
Apply stroke and color attributes to the path of this element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be some orange color) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Add Step & Repeat Set modification to this element with **Add Step & Repeat Set** command from **Excentro Control** window menu. Enter following values in fields of new Set:

◆ **Number of Steps** = '*8*' (the same value as that of the first content element)

◆ **Phase** — click **Auto** checkbox beside numeric field and **Phase** attribute value will be automatically calculated so that 8 paths of the content element cover whole [0°; 360°] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



Third Content Element: Paths of this content element form vector pattern between the path of the third regular element and the path of **Line** base object. Select the third regular element with mouse click in main document window, then press down **Shift** modifier key on keyboard and click with mouse pointer **Line** base object. Choose **New Element** command from **Structure** menu to create new content element. After that in **Excentro Control** inspector choose:

◆ '*Blend*' from **Type** pop-up menu

Enter following attributes in appropriate fields:

◆ **Ratio** = '*0%*' (we are going to apply Step & Repeat Set to this object later, to cover whole [0%; 100%] interval, let us set initial value of the first original path to 0%)

◆ **First Base Offset** = '*–1.5 pt*' (let us offset this path by 1.5 points from the paths of its parent elements)

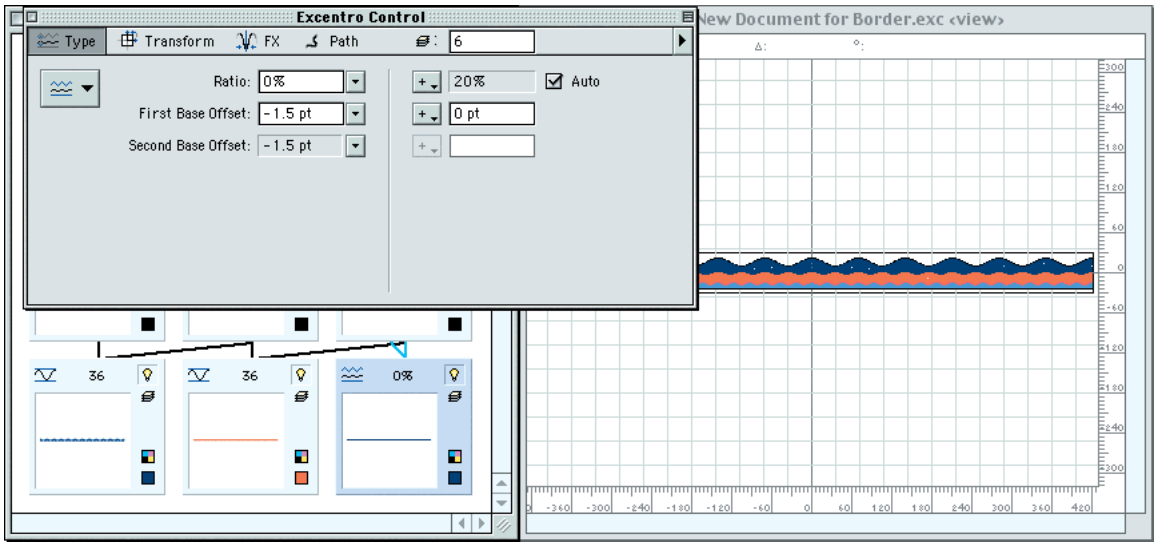
◆ **Second Base Offset** = '*–1.5 pt*' (this value is automatically set by '*Same as First Base Offset*' option in pop-up menu beside this field)

Apply stroke and color attributes to the path of this element: switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 70–80 microns or 0.2–0.25 points. Mix appropriate color (let it be the same blue color as that of the first content element) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**.

Add Step & Repeat Set modification to this element with **Add Step & Repeat Set** command from **Excentro Control** window menu. Enter following values in fields of the Set:

- **Number of Steps** = '6' (this will make a set of 6 paths: the original path of the content element and 5 additional paths)
- **Ratio** — click **Auto** checkbox beside numeric field and **Ratio** attribute value will be automatically calculated so that 6 paths cover whole [0%; 100%] interval

Rest of Step & Repeat Set increment fields should be left at their initial zero values. You should get following picture on your screen:



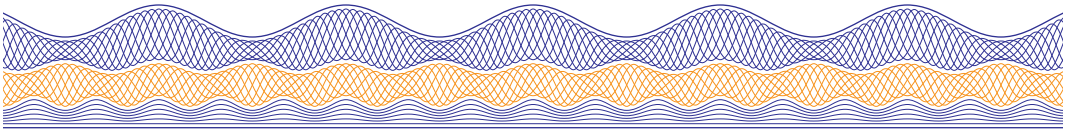
The construction of the border is finished.

The path of **Line** base object and the path of the first regular element form top and bottom borders of our design. Let us keep these paths visible and make their stroke weight thicker than that of other paths. Select **Line** base object, switch to **Path** panel of **Excentro Control** inspector enter **Stroke** weight of 150–200 microns or 0.4–0.5 points. Mix appropriate color (let it be the same blue color as that of the first and the third content elements) in **Color Mixer** and drop its color patch to **Color Well** of **Excentro Control**. Then select the first regular element and apply to it the same **Stroke** weight attribute and color values.

As the very last step switch to **Path** panel of **Excentro Control** inspector and switch off **Visible** check box for the second and the third regular skeleton elements to make these paths invisible.

The final border picture and guilloche tree structure should look exactly like the ones shown on the first pages of this chapter.

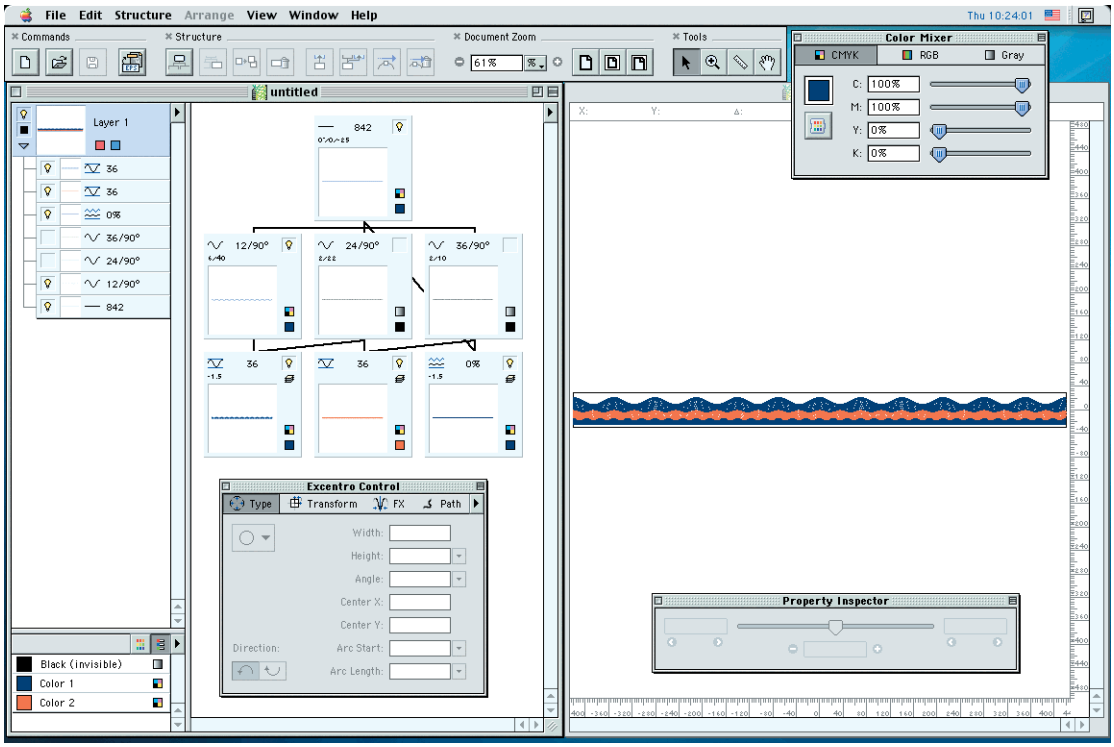
Now you can export this border in *Adobe Illustrator* format using **Export** command from **File** menu and use it as a part of certificate, diploma, etc. Below is one more picture of the border in vector form:



TEMPLATE AND EXAMPLES

Stationary file '**Border Template 1.exc**' from '**Excentro Templates**' folder contains a copy of the document we created in previous section. You can use this template to create new borders by modifying attributes of its objects without a need to reconstruct them in new file as was described above.

■ **Template Usage.** Launch *Excentro* application and open '**Border Template 1.exc**' file. New **untitled** document that contains copy of stationary file content will be opened in front of you:



Save this new document to whatever location on your hard disk you use for guilloche designs giving it meaningful name. Now you can modify objects attributes and create your custom borders from this template:

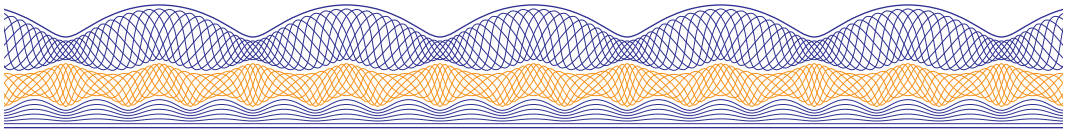
- ◆ You can change color attribute of the objects. The easiest way to do so is to redefine '*Color 1*' and '*Color 2*' entries in the document colors list. Just drag color patch from **Color Mixer** or swatch palette window to color patches (small colored rectangles) of '*Color 1*' or '*Color 2*'. This will automatically change color attributes of the objects that use this colors list entry.
- ◆ You can modify objects attributes. For example: change of object's **Type** will modify its shape making it 'saw-like' or 'tooth-like' instead of wavy or cycloid; change of object's **Frequency** will add or reduce number of waves or coils its shape has; change of **Side Size** of the **Cycloid** will make its coils smaller or larger, etc.
- ◆ You can add new elements to the border. This will increase number of paths the border consists of making pattern more complex and intricate.
- ◆ You can modify attributes of Step & Repeat Set changing number of paths that form the border or shape of these paths.

Examples of this template usage are located in '**Border Template 1 examples**' folder. They show most typical variations you can create using '**Border Template 1.exc**' template.

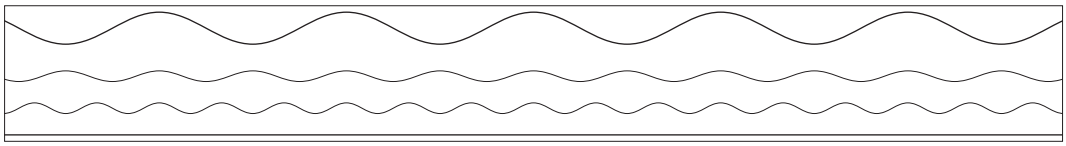
Let us take a quick look at examples of '**Border Template 1.exc**' variations from '**Border Template 1 examples**' folder.

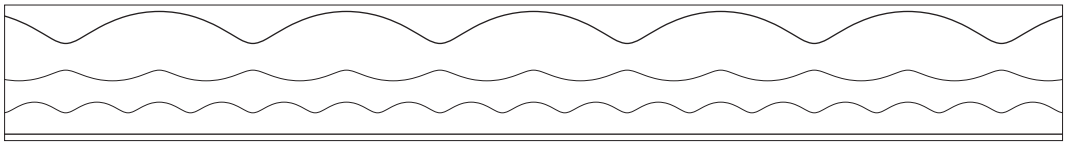
■ **Border Shape Variations.** The first three examples show how you can modify shape of the border or shapes of its top, middle and bottom areas by changing attributes of several regular elements that form its 'skeleton bones'.

◆ **Example 1:** In this example we modified shapes of the regular elements to make our border design look a bit more interesting. We changed **Type** of all regular elements to '*Cycloid*'. **Side Size** attribute of the first element is set to '*–5 pt*', **Side Size** attribute of the second element is set to '*2 pt*', **Side Size** attribute of the third element is set to '*–1 pt*':



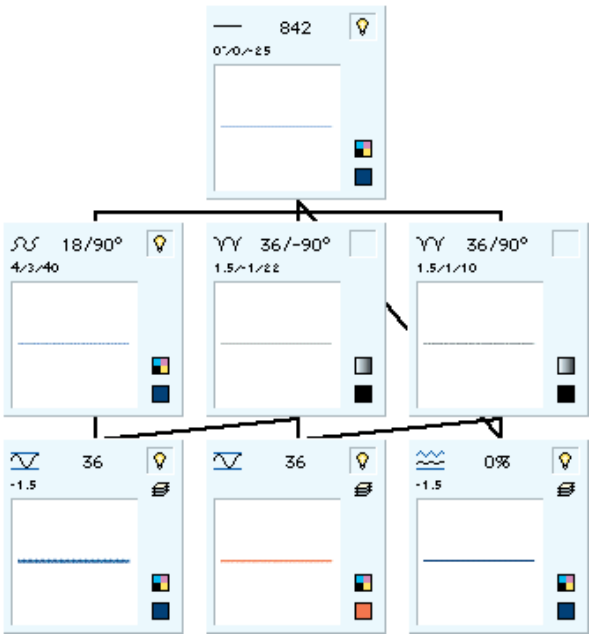
Two following pictures let you compare skeleton paths of the original template (the first picture) with skeleton paths of this example (the second picture):

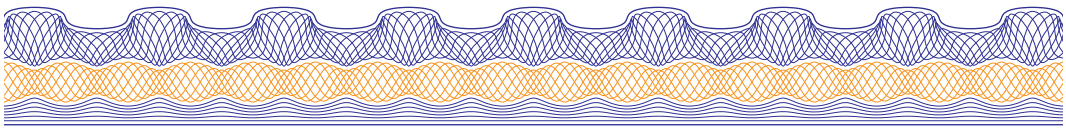




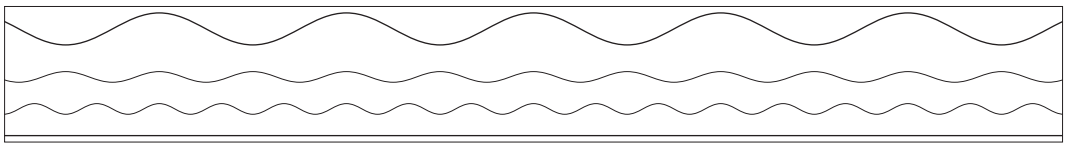
◆ **Example 2:** In this example we set **Type** of the first regular element to '*Eight*' and it attributes to: **Frequency** = '*18*', **Phase** = '*90°*', **Amplitude** = '*4 pt*', **Side Size** = '*3 pt*', **Base Offset** = '*40 pt*'. The second element: **Type** = '*Cycloid*', **Frequency** = '*36*', **Phase** = '*–90°*', **Amplitude** = '*1.5 pt*', **Side Size** = '*–1 pt*', **Base Offset** = '*22 pt*'.

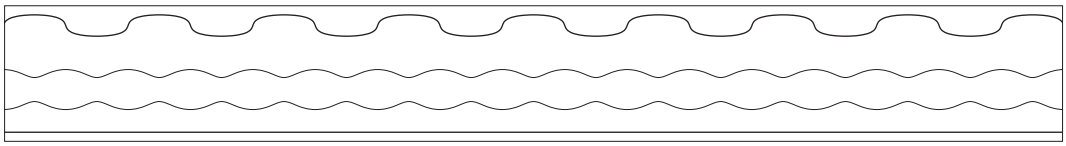
The third element: **Type** = '*Cycloid*', **Frequency** = '*36*', **Phase** = '*90°*', **Amplitude** = '*1.5 pt*', **Side Size** = '*1 pt*', **Base Offset** = '*10 pt*'. As you can see paths of the second and the third elements have similar shapes, but path of the third element appears to be 'inverted' with swells locations opposite to the path of the second element:



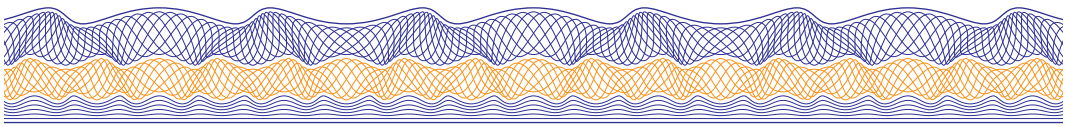


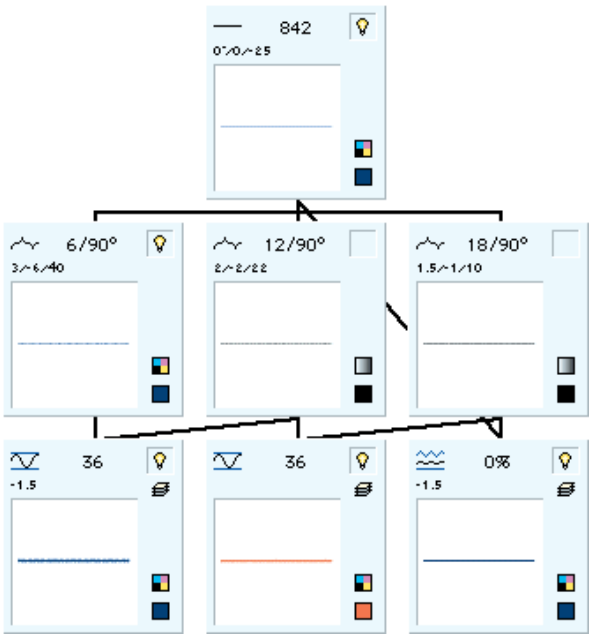
Two following pictures let you compare skeleton paths of the original template (the first picture) with skeleton paths of this example (the second picture):



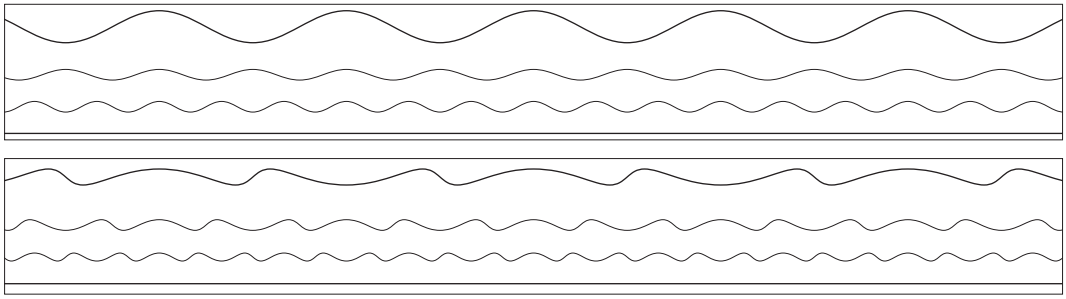


◆ **Example 3:** In this example we changed **Type** of all regular elements to '*Brace*'. The first element now has attributes: **Frequency** = '*6*', **Phase** = '*90°*', **Amplitude** = '*3 pt*', **Side Size** = '*–6 pt*', **Base Offset** = '*40 pt*'. The second element: **Frequency** = '*12*', **Phase** = '*90°*', **Amplitude** = '*2 pt*', **Side Size** = '*–2 pt*', **Base Offset** = '*22 pt*'. The third element: **Frequency** = '*18*', **Phase** = '*90°*', **Amplitude** = '*1.5 pt*', **Side Size** = '*–1 pt*', **Base Offset** = '*10 pt*':





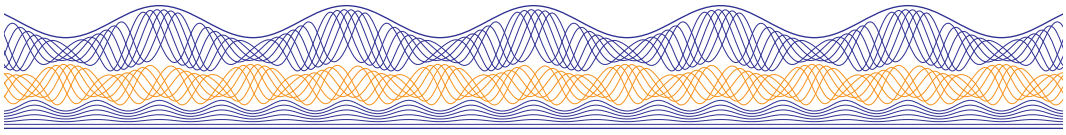
Two following pictures let you compare skeleton paths of the original template (the first picture) with skeleton paths of this example (the second picture):

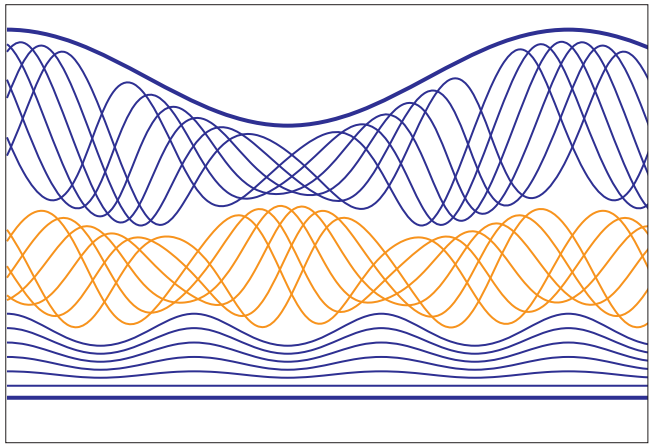


■ **Border Content Variations.** Next four examples show variations of the border 'vector texture' formed by its content elements. **Line** base object and the regular elements that construct 'skeleton bones' of the border will remain the same in these examples as they were in the original template file:

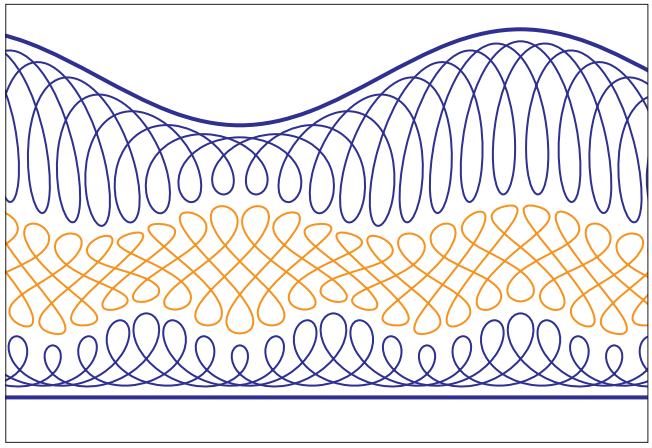
◆ **Example 4:** This example shows effects of 'incomplete vector texture' with several paths removed from Step & Repeat Sets of **Sine Wave** content elements. This effect produce nice looking patterns in some cases.

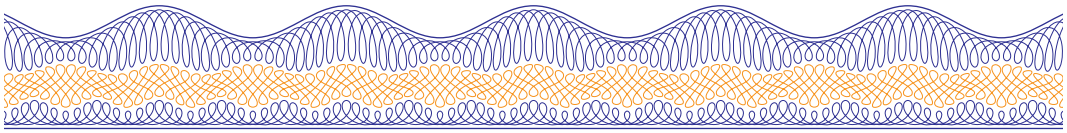
Uncheck **Auto** checkbox beside **Phase** attribute in Step & Repeat Set fields of the first and the second content elements. After that reduce **Number of Steps** for these elements Step & Repeat Sets to '*6*' (from original '*8*' value). **Phase** increment value remained fixed at '*45°*', because **Auto** checkbox was switched off. Now paths in the Step & Repeat Sets do not cover whole [0°; 360°] interval. To make remaining pattern more symmetric in relation to waves of parent regular elements change **Phase** attribute of the first content element to '*–30°*' and **Phase** attribute of the second content element to '*150°*':





◆ **Example 5:** In this example we set **Type** of the first content element to '*Cycloid*' and it attributes to: **Frequency** = '*72*', **Phase** = '*90°*', **Side Size** = '*–4 pt*', **First Base Offset** (and **Second Base Offset**) = '*–1.5 pt*'. The second element: **Type** = '*Eight*', **Frequency** = '*72*', **Phase** = '*–90°*', **Side Size** = '*–3 pt*', **First Base Offset** (and **Second Base Offset**) = '*0 pt*'. The third element: **Type** = '*Cycloid*', **Frequency** = '*72*', **Phase** = '*90°*', **Side Size** = '*3.8 pt*', **First Base Offset** (and **Second Base Offset**) = '*–1.5 pt*'. **Number of Steps** for these elements Step & Repeat Sets is set to '*3*':

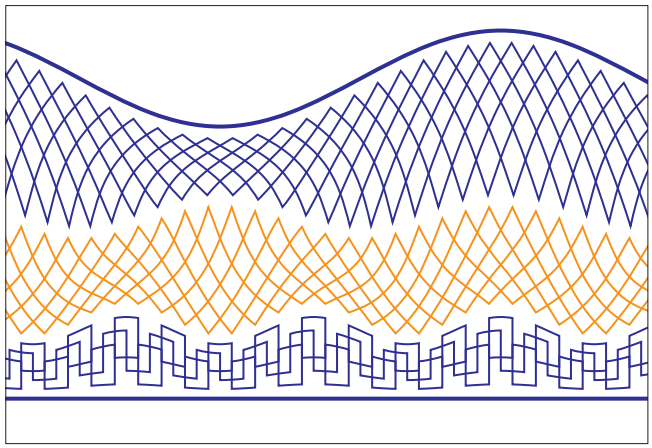


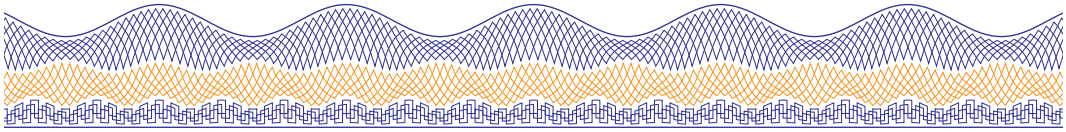


◆ **Example 6:** In this example we set **Type** of the first and the the second content elements to '*Spade*'. The attributes of the first content element: **Frequency** = '*48*', **Phase** = '*0°*', **Side Size** = '*–1 pt*', **First Base Offset** (and **Second Base Offset**) = '*–1.5 pt*'. The second element: **Frequency** = '*48*', **Phase** = '*0°*', **Side Size** = '*1 pt*', **First Base Offset** (and **Second Base Offset**) = '*0 pt*'. **Number of Steps** for these elements Step & Repeat Sets is set to '*6*'.

Type of the third content element was set to '*Notch*'. Its attributes: **Frequency** = '*144*', **Phase** = '*90°*', **First Base Offset** (and **Second Base Offset**) = '*15%*'.

Auto checkbox was switched off for Step & Repeat Set of the third content element. **Number of Steps** was set to '*3*', **Phase** increment in Step & Repeat Set field was set to '*90°*', **First Base Offset** increment — to '*14%*':

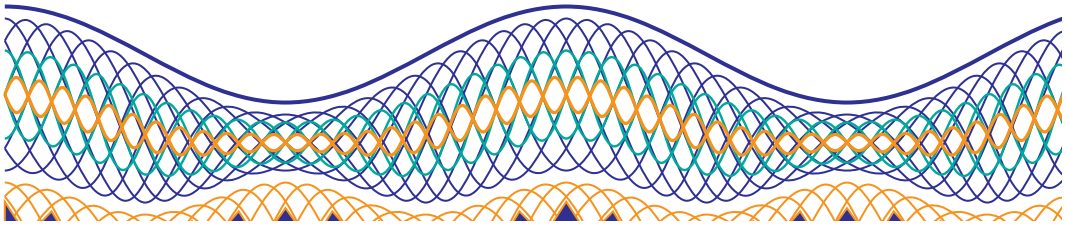




◆ **Example 7:** In this example we added three more content elements to the border design of our template.

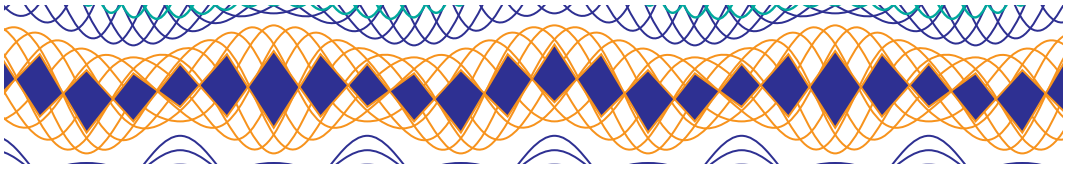
The first content element was duplicated twice. The first copy got attributes: **Frequency** = '*72*', **Phase** = '*0°*',**First Base Offset** (and **Second Base Offset**) = '*25%*', **Number of Steps** in its Step & Repeat Set was reduced to '*4*'. The path of this new element was colored with new green color patch. The second copy got attributes: **Frequency** = '*144*', **Phase** = '*0°*',**First Base Offset** (and **Second Base Offset**) = '*40%*', **Number of Steps** in its Step & Repeat Set was reduced to '*2*'. The path of this new element was colored with orange color.

As you can see on the following picture (see next page) paths of all three content elements that were constructed between the first and the second regular elements of border's 'skeleton' overlap nicely to produce three color pattern. Stroke weight of two new elements was set to slightly larger value comparing to that of the original first content element.



The second original content element (between the second and the third 'skeleton' regular elements) was duplicated too. The new copy got attributes: **Type** = '*Star*', **Frequency** = '*72*', **Phase** = '*90°*',**First Base Offset** (and **Second Base Offset**) = '*20%*', **Number of Steps** in its Step & Repeat Set was set to '*2*'.

The paths of two content elements between the second and the third regular elements also overlap to produce two color pattern. The paths of the second (new) content element was later joined in *Adobe Illustrator*, filled with the blue color and stroked with the orange one.



The last content element (the one between the third regular element and **Line** base object) was changed to: **Type** = '*Sine Wave*', **Frequency** = '*36*', **Phase** = '*90°*', **First Base Offset** (and **Second Base Offset**) = '*15%*'. Now it has two Step & Repeat Sets. The first set has attributes: **Number of Steps** = '*2*', **Phase** = '*Auto*'. The second set has attributes: **Number of Steps** = '*3*', **First Base Offset** = '*15%*'.

This content element and its Step & Repeat Sets produce total of 6 blue colored paths that fill space of the bottom part of the border:

Illustration of the finished guilloche structure and the border design in vector form: