Guilloche Pattern Generation for creating visible watermark

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ABSTRACT

Guilloche is a decorative, architectural element and an engraving technique which is very intricate, yet precise, recursive pattern or design. Guilloche elements are created step by step. Firstly the basic structure is selected on which subsequent steps will be built. The basic figures are designed using concepts of co-ordinate geometry which will result in the guilloche element. Bases designed are: a line, a circle, an ellipse, a polygon, an ellipse's arc, circumscribed polygon in circle and ellipse, stars concave and convex, floral pattern etc. The phase, the shifting, the frequency, the inclination and only after that the functions on filling the space between the given curves are set. The filling is a multitude of lines, built on the basis of two envelope curves with the use of chosen functions. Creation of guilloche elements on the base of cyclic functions enables to improve the quality of an image and controls every dot of a document. It was investigated that guilloches are formed by graphic primitives, such as a line, a poly-line, an arc, an oval, a rectangle etc. as well as other more difficult compositions: a border, a vignette, corners and baseline grids. Also the algorithm of guilloche elements creation based on cyclic functions that enable to improve quality of an image and performed control in every dot of a document is developed.

1. Introduction

Guilloche is a decorative, architectural element and an engraving technique which is very intricate, yet precise, recursive pattern or design. These decorative patterns are developed by French engineer and are named after him. He invented a machine that could scratch fine patterns and design on metallic surfaces. The machine improved upon the more time consuming practice of making similar designs by hand. These patterns can also be engraved on jewelry and watches, erected on stones or woods for architecture. These are vintage design elements that were frequently used for anti-counterfeiting security purposes on buildings, factories, jewelries etc used over two hundred years.

These patterns are also called symmetrical patterns. Guilloche design are now a days in our everyday life, for example bills, checks, ID cards, passports, driver licenses, auto registration certificates, fiscal marks, policy forms and licenses, travel documents, tickets, and several documents including academic diplomas or certificates. Any kind of document that requires some complex graphics to avoid being forged and falsification are using it in some way or another.

The guilloche images are difficult combinations of thin and continuous lines which have a difficult structure and typical spacing of 1-2 mm or any suitable measurement. Basic Bases can be the followings types for designing: a line, an ellipse, a polygon, a rectangle, a poly-line, an ellipse's arc, an oval, a spl6ine, a spiral, an evolvent, a lissage. These are used to design various types of complex guilloche patterns.

Guilloche pattern are Periodic patterns often present on document images as holograms, watermarks or guilloche elements which are mostly used form fraud and falsification. Improving the security aspect of the watermarking system, without any cost of imperceptibility and robustness, is one of the challenges of today's research in watermarking. Watermarking is sometimes used for document security but guilloche pattern are mere specific as it can be used in the number plates of the car or we can say guilloche patterns are embroider on alphabets.

Gullioche patterns use various techniques few of them are explained below. One of which is reverse-stencil technique, the outline of the pattern is drawn directly on to the surface on which it is to be applied; mortar or adhesive is then spread over small sections of the pattern and tesserae are inserted into it piecemeal; once the pattern emerges the background is filled in. Since the pattern is stenciled in directly this technique is called the 'direct method'. The direct method can also be used in workshops to produce panels of mosaics on a solid base that can be transported to the site and fixed in place. This pattern is printed onto the photographic layer before the photographic data are recorded. In order to increase their protection against forgery, the picture and text parts are additionally provided with a printed pattern in the form of thin wavy lines, etc.

2. Related Work

[1] It is discussed about protecting document images from fraud by Periodic patterns such as holograms, watermarks or guilloche elements and these patterns are processed using automatic document processing system. of periodic pattern detection on document images which use discrete Fourier transform. [4] Guilloche provides degree of securities protection. This pattern cannot be exactly reproduced on a digital manigraph due to small thickness of lines and the constant change of curvature of every line. Even It is difficult to scan monochrome guilloche elements, they are periodic elements that repeat themselves and require the enormous memory arrays of the PC, and that complicate the work of computer. The popular vector graphics editors, primarily Adobe Photoshop, Adobe Illustrator and CorelDraw

3. Proposed Work

The aim is to create algorithms for designing guilloche patterns. These patterns are so complex such that there is less chance of forging the data on which patterns are applied. Anti aliasing is also done for clear view of images. These patterns are created using basic structure. These basic structures are formed using coordinate geometry. The images formed can be viewed clearly without overlapping.

We are going to discuss here how we have created the guilloche patterns using basic structures such as a point, a line, a circle, an ellipse, a star which can be pinpoint or a convex and a concave star. These are used to design various types of complex guilloche pattern such as floral pattern and flower in flower pattern, polygon in ellipse, polygon in circle etc.

3.1 Point –A geometrical point is a location in space. It has no other characteristics. It has no length, width or thickness. In geometry the word point is not defined. It is one of the undefined primitives that are used to define other objects. In creating complex guilloche patterns we will consider a point as a pixel on graphics screen. Basically its all about points that are together used to form other shapes like lines, circles, ellipse, star etc

ALGORITHM

1) Provide size of window by giving height and width.

2) Provide white background in the frame using Matlab functions.

3) Create a function that gives circle points in output. We have created *getcirclecords(radius, npoints)* for the same.

4) In the function, we have taken an angle that is displaced between 0 to 360 degree.

5) Using the sine and cosine functions are used to get circle points.

6) Plot the points using colour model.

3.2 *Line* –A line connects 2 points. It is basic element in graphics. To draw a line, you need two points between which you can draw a line. Algorithm used Digital Differential Analyser. Serve as a base for all linear borders and backgrounds designs.

3.3 *Circle* –A circle is a simple closed shape in Euclidean geometry. It is a set of points in a plane that are at a given distance from the centre. It divides the plane into two regions. First, interior and Second, exterior. It can also be defined as a special kind of ellipse in which the two foci are coincident and the eccentricity is zero. We have used number of points and radius to get circle coordinates and to draw a circle in image.

ALGORITHM

1) Provide size of window by giving height and width.

2) Provide white background in the frame using Matlab functions.

3) Provide radius, number of points and the colour of circle you want to create.

4) Create a function that can create a circle in image. We have created *drawcircleinimage(I, radius, npoints, windowsize) for the same.*

5) Save the output image.

3.4 *Ellipse* –An ellipse is a curve in plane. Algorithm for ellipse is given by getellipsecords( ) by using the formula perimeter of ellipse.

3.5 *Star* – using phase shift operation in getcirclecords those points are joined by interpolation of line and an star pattern is obtained also it can change the points of the star pattern so as to obtain various type of star pattern. Also concave and convex star are also designed shown in results.

ALGORITHM

1) Provide size of window by giving height and width.

2) Provide white background in the frame using Matlab functions.

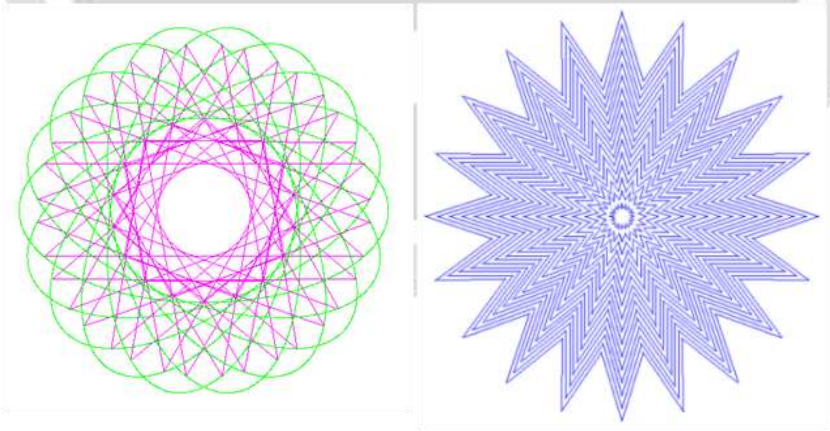
3) Provide radius, number of points and the colour of circle you want to create.

4) Create a function that can create a circle in image. We have created *drawcircleinimage(I, radius, npoints,windowsize) for the same.*

5) Phase Difference between the circle points is obtained and these points are joined by interpolation function.

6) Save the output image.

Above algorithms are basic bases which are used in designing guilloches. With the combinations various patterns are obtained.



4. CONCLUSIONS

By using the complex patterns we can generate document security and product commercial protection. This is very important as reliable information is valued most of all in the world. The prestige of firm depends on quality of its product and that is why the reaserch of the effective methords of protection is the topic of interest.

Also the algorithm of the guilloche elements depends on the cyclic functions that enables to inprove the quality of image and performed control in every dot od document is developed.

6. REFERENCES

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