

A TOOL FOR DIVISION OF EXPOSITION TO SECTIONS OF NON-RECTANGULAR SHAPE

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ABSTRACT

An idea for reduction of a bad impression caused by different efficiencies of diffractive gratings in different parts of exposition field using a simple method of dividing exposition to sections of desirable shape was proposed.

1 INTRODUCTION

The work of laboratory of Electron-Beam Lithography in Institute of Scientific Instruments of Academy of Sciences of the Czech Republic is focused to the development of diffractive structures. An electron beam lithograph BS600, developed in the Institute of Scientific Instruments and improved in project ELITO, is being used. The dimension of diffractive structures developed is in a range of square centimetres. The maximum dimension of a side of the exposition field is slightly higher than three millimetres. Structures larger than three millimetres have to be exposed sequentially. The table with attached substrate with a layer of electron beam resist is moved using a step engine. The position of the table is checked using an interferometer with accuracy of 1 nm. The problem of continuation of exposition fields had been solved in [1], but did not eliminate the problem caused by distortion of a shape of elementary exposition and consequentially the beam-dose absorbed by resist in different positions of the exposition field. Different shape of elementary expositions causes changes in efficiency of diffractive gratings which brings a bad impression. Exposed structures are often separable to sections, which could be exposed within one exposition field. A tool for generation of exposition data divided to exposition fields of desired shape was needed.

2 PROCESS OF DIVISION

Exposition fields are fully described by their position, size and shape. Bitmaps are used to describe the exposed image in order to reduce the amount of data. The size of the bitmap is limited. The limit is for the most frequently used formats of the bitmap 2^{16} for the width and 2^{15} for height. The use of bitmaps adds another parameter, the resolution. The highest

resolution available is the resolution of the lithograph, which is 100 nm. The lowest resolution is dependent on the degree of detail used. The shape of the exposition field can be described using a bitmap. It is useful to have description of all the exposition fields in one bitmap in order to reduce the probability of exposing any of the points twice. The input data necessary to divide the exposition are: the exposed drawing and shapes of exposition fields. The input data, necessary to bind the exposition fields into exposition data, can be stored in a matrix describing position, size and order of bitmaps with the shape of the fields. The position and size of the exposition field is stored in pixels, a unit not dependent on the resolution used. The order of exposition is the binding point connecting these two processes, therefore the order of the exposition fields has to be known already during the division. The information of position and size is also useful in the process of division for reducing the amount of memory used, especially, if the resolution of the drawing is not equal to the resolution of the bitmap describing the shape of the exposition fields.

3 PREPARATION OF THE INPUT DATA FOR DIVISION

Input data for division have to be created as a pattern of division. The pattern is well designed; if the sizes of fields do not differ much and the edge of the shape is not approaching the centre of the exposition field. It is useful to design the pattern in vector graphic for the case of need to changing the resolution. The pattern processed is a black and white bitmap in a resolution chosen. The process of creation of the input data for division is based on finding continuous areas in the given bitmap and assigning an order number. The edges of the continuous areas have to be exposed, therefore are included to exposition fields. The order of expositions can be changed after processing the pattern.

4 CONCATENATION OF EXPOSITION FIELDS FOR EXPOSITION

The coordinates describing movements of the table with substrate are related to its actual position. If the size of the area of the exposition field used for exposition was constant, the coordinates of the movement of the table would be equal to the residual of the subtraction of the absolute coordinates of the positions of the exposition fields multiplied by the resolution of the dividing pattern. The distortion of the exposition field is supposed to be minimal in its centre; therefore the exposed structures are preferably placed in the centre of the exposition field. If the sizes of exposed fields differ, the coordinates of movements are affected by subtraction of dimensions of the exposed fields.

5 CONCLUSION

A set of algorithms, for creation of input data for division, rearranging input data, dividing the exposition and binding the exposition fields for exposition, was created. The set of algorithms creates a tool for dividing expositions into exposition fields of desirable shape. This development was partially supported by GAČR project 102/05/2325.

REFERENCES

- [1] Daněk L.: Calibration of the Deflection Field of the Lithograph Using SEM Mode Student EEICT 2004, 570-575.