Orthogonal Placement of Different Overall Components in Plane

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Abstract – **Report covers problems of different overall orthogonal components placement in plane and methods of solving during the electronic equipment form-factors and material cutting outlines design. It is introduced advantages of genetic algorithm usage.**

Keywords – **placement, genetic algorithm, cutting task.**

I. INTRODUCTION

Different overall orthogonal components placement in plane task is still topical during design such electronic equipment form-factors as computer's motherboard, supply board, VLSI crystals and hybrid integrated circuit. Similar tasks arise also with different material type of cutting outlines design – containerboard for equipment packing, wood in furniture manufacturing, metal in machinery construction and textile in light industry. For solving all set of such tasks the best self recommended are algorithms of sequential type and evolutional (genetic) algorithms.

II. DIFFERENT OVERALL COMPONENTS OF ELECTRONIC EQUIPMENT PLACEMENT

Tasks of this type rise either with printed circuit card design (PC motherboards, supply board, etc.) or integrated circuits topology design (low-frequency hybrid integrated circuits, crystal surface planning and forming of LSI pockets). Anyway two traditional choice tasks should be sold – choice of element or component for placement (applicant's tuple forming) and choice of slot for following applicant.

Applicant's tuple forming is possible to perform in several ways. First of them consists in building of sequential optimal reduction tree on basis of C-electric coupling matrix, its elements point on number of electric circuits between elements and components of scheme. Sequential optimal reduction tree enables to definitely form applicant's tuple. Second variant considers task of different overall placement as multiparametric and as addition inputs S matrix of minimal free squares every element of which is equal to minimal difference of descriptive rectangle square of two elements, situated abreast and aggregate square of this elements. In addition during complex K matrix forming for sequential optimal reduction scheme it is enabled to take into account topologic distance between elements which is set with T matrix every element of this matrix is equal to topologic distance between two elements according to appropriate number of scheme's graph's edges in which vertices are appropriate to scheme's elements and edges – relations. Thus, element of resulting K matrix that functions as input data for forming of applicant's tuple at optimal reduction tree is integrated parameter of electric, geometric and topologic coupling of scheme elements. This enables to form set of applicant's tuples for taking into account peculiarity of concrete placement task (depends on designed form-factor) with the help of multiplicative or adaptive method of receiving of integrated K matrix parameter's meanings.

For defining position of following applicant for placement there are analyzed positions of 1st round of free in relation to busy one and is chosen the best one according evaluation of aggregate relations length.

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III. TEMPLATE PLACEMENT OPTIMIZATION

For template placement optimization well self recommended themselves genetic algorithms. Before starting genetic algorithm it is necessary to cover work parameters and criteria of given algorithm. To describe solving chromosome you have to use diploid model that consists of two chromosomes. In the first one it is saved data about order of component's placement, in the second one – which components should be turned to 90 degree. To simplify placement process the area it is performed in should be divided into segments.

The beginning of algorithm work is accepting of arbitrary sequence of components for following optimization in general. After this you have to change the order of component's placement using main genetic operators. During the algorithm's work process are chosen decisions which guarantee high quality of solving for account of reducing material loses. In that case when string width of certain components is higher than segment width it is performed turning of components on 90 degree. If after that process the component width is not lower or equal to segment width the last component is shifted to next string of segment. But if components in segment had situated without any loses all manipulations are stopped. Given segment will be moved up to next generations without any changes. So we can say that components that are in this segment occur at pattern that is not changed until the algorithm is in process. This enables faster finding of optimal placement task solving.

IV. CONCLUSION

Different overall placement algorithms on basis of orthogonal models of components were realized at CAD HIC "TOPOS" [1]. For genetic algorithm research it was developed appropriate software [2] and carried a comparison with results of software implementation that don't use genetic algorithms (RealCut2D) and was gained a positive result in favour of evolutionary type algorithm.

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