IMPROVING THE QUALITY OF MESHES FOR THE SIMULATION OF SEMICONDUCTOR DEVICES USING LEPP-BASED ALGORITHMS

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A Delaunay mesh without obtuse angles opposite to boundary and interfaces is the basic requirement for semiconductor device simulation when the devices are simulated using the Box-method. In addition, due to the geometry of the devices, it must be possible to represent very thin layers, and due to physical properties, it is desired that edges be parallel to the current flow. The previous requirements should be fulfilled using as few points as possible. The Box-method tolerates very well longest edges and shortest edges perpendicular to them which are very useful to solve boundary parallel currents. In addition, small angles do not produce convergence problems but it is recommended to avoid too big obtuse angles and nodes with too high edge connectivity (number of edges that converges to a vertex).

Meshes generated by a normal offsetting approach [1] have been successfully used in the simulation of semiconductor devices because these meshes adapt very well to the requirements described before. The normal offsetting is done separately in each region, using quadrilaterals. Then, the mesh is transformed into a triangulation and a Box-method conforming Delaunay mesh is done by using (a) orthogonal refinement for the elimination of boundary/interface obtuse triangles, and (b) Voronoi point insertion [2] for improving the quality of deteriorated triangles and for the generation of a graded mesh between regions with different refinement level.

This paper presents a different algorithm to generate Box-method conforming Delaunay meshes from Delaunay constrained meshes with already fulfilled density requirements. It takes as input a Delaunay constrained mesh, a maximum angle and a maximum edge connectivity (ϵ and c, respectively), and generate as output a where all maximum angles of each triangle are less than or equal to ϵ and no mesh point has equal or higher edge connectivity than c. The improvement of the triangles with maximum angle larger than ϵ and of the triangles around a point with edge connectivity larger or equal to c is done by the LEPP based Delaunay point insertion algorithm described in [3]. The elimination of obtuse angles opposite to boundary and/or interfaces is done by longest edge bisection or by the generation of isosceles triangles as described in [4]. The LEPP point insertion algorithm permits a natural elimination of large obtuse angles and of high edge connectivity by inserting few points in already existing edges. Examples of the use of the algorithm over Delaunay constrained meshes generated by a normal offsetting approach will be shown and a comparison with the method to improve the mesh quality described in [1] will be given.

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References

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