

RESUMO N° 88

SURFACE INSERTION IN A TETRAHEDRAL MESH USING THE MECCANO METHOD

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This work presents an innovative method to insert an open surface in a tetrahedral mesh. The insertion of a surface in a mesh can be done with 2 different approaches: introduce the surface to the geometry before generating the mesh, or insert the surface once the mesh is generated. This work uses the second approach. Essentially, the surface is first approximated by a set of faces of the existing mesh. This set is refined to obtain a more accurate approximation. Finally, the set is processed to satisfy some topological properties and projected to the actual surface.

The strategy is based on a mesh generated by the Meccano Method [1]. In a first stage, the cells intersected by the surface triangulation are refined using the Kossaczky algorithm. The refined cells form a volume with the surface enclosed. One side of the volume's boundary defines a set of faces considered as an initial rough approximation. The nodes of these faces are projected to the actual surface by using a simultaneous Floater parametrization [2] to the same rectangular domain. This projection can generate an invalid mesh. To obtain a valid mesh and improve its quality, it is optimized using the Simultaneous Untangling and Smoothing technique [3].

The proposed method provides a smooth approximation, suitable for operations over surfaces where roughness is a major problem, like estimation of normal vectors and imposition of Neumann conditions.

References:

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