Mesh Smoothing for Triangulations Defined on Surfaces

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This paper presents a new procedure to improve the quality of triangular meshes defined on surfaces. The improvement is obtained by an iterative process in which each node of the mesh is moved to a new position that minimizes certain objective function [2]. This objective function is derived from an algebraic quality measures of the local mesh [1] (the set of triangles connected to the adjustable or *free node*). The optimization is done in the *parametric mesh*, where the presence of barriers in the objective function maintains the free node inside the *feasible region*. In this way, the original problem on the surface is transformed into a two-dimensional one on the *parametric space*. In our case, the parametric space is a plane, chosen in terms of the local mesh, in such a way that this mesh can be optimally projected performing a *valid* mesh, that is, without *inverted* elements. Several examples and applications presented in this work show how this technique is capable to improve the quality of triangular surface meshes.

References

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[2] L.A. Freitag, P.M. Knupp, *"Tetrahedral mesh improvement via optimization of the element condition number"*, Int. J. Num. Meth. Eng., 53, 1377-1391, 2002.