

ALL YOU NEED IS A SINGLE MESH... A UNIVERSAL MESH

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Abstract

We discuss our recent results on constructing Universal Meshes for piecewise - C^2 domains in \mathbb{R}^2 .

A Universal Mesh for a set of curves is a mesh of triangles (or tetrahedra in \mathbb{R}^3) that can be deformed to conform to any curve in the set. This is particularly advantageous for problems with moving domains, such as fracture propagation or some fluid-structure interaction problems.

The mesh-deformation algorithm we introduce consists of two parts: (1) Given a piecewise - C^2 curve immersed in the universal mesh, identify a set of edges that is homomorphic to the curve under a map that is closely related to the closest-point projection to each smooth part of the curve, and (2) a mesh-relaxation strategy, called Directional Vertex Relaxation, to move nearby triangles and accommodate the motion of such edges. Our results provide conditions under which part (1) is possible. This also defines a set of curves that a Universal Mesh can be conformed to. We will show applications of the Universal Mesh to crack propagation problems, and if time permits, to three dimensional geometries.

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