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A 2D Multi-Block Decomposition & Virtual Topology Engine for Quasi-Structured Mesh Generation.

Jonathan E. Makem[a]*, Nilanjan Mukherjee[b], Mark Lamping[b]

Meshing & Abstraction, Digital Factory, Simulation and Test Solutions Siemens PLM Software, SIEMENS.
[a]Francis House, 112 Hills Road, Cambridge, UK. CB21PH.
[b]2000 Eastman Dr., Milford, Ohio 45150 USA.

Abstract

In surface meshing, for certain structural mechanics applications, quasi-structured or predominantly structured quad meshes are much preferred over unstructured tri/quad alternatives as the accuracy, robustness, and solver convergence rate is significantly improved. Nevertheless, in contrast to tri meshing where automated methods for producing meshes are well established, significant manual effort is still required to generate a good quality quad mesh. The technique presented here aims to automatically sub-divide any complex face into simple, well-shaped convex "blocks" using a novel system of feature-dependent block decomposition strategies which facilitate high-quality mapped meshes. The overall framework for achieving this objective is represented in the form of a Multi-Blocking and Virtual Topology Engine comprising three tiers, as shown in the poster. The first tier consists of a "Feature Recognition" component which categorizes the input surface using a series of intelligent topology and geometry based identification tools. Depending on the type of surface identified, an appropriate Multi-Blocking strategy is applied by the "Multi-Block Decomposer" in tier 2. Finally, once the location of the blocks has been defined, the virtual block topology is established by the topology builder in tier 3, creating virtual faces and enabling the generation of a pro-structured, conformal mesh between adjacent blocks.

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Keywords: multiblock decomposition; quadrilateral meshing; virtual topology; medial axis; shell meshing;

* Corresponding author. Tel.:+441223371622
E-mail address: jonathan.makem@siemens.com

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