

# A SURVEY OF HEX MESH MODIFICATION TECHNIQUES: WHERE WE ARE AND WHERE WE ARE GOING

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The development of algorithms that effectively modify all-hexahedral finite element meshes is currently an active area of research. Mesh modification can be used to improve mesh quality, reduce the time required to create a mesh, and improve finite element analysis results. Automatic, local modification of all-hexahedral meshes, however, has proven elusive because of the global effects of local modifications. This presentation will cover several hex mesh modification algorithms including refinement, coarsening, grafting[1], and mesh cutting[2][3]. A discussion of the work that the authors and others have done in mesh modification will introduce the topic and examples will be shown that illustrate the current abilities of the different algorithms.

The presentation will then focus on the future needs and possible research directions of mesh modification. This discussion will include the need for more general mesh coarsening algorithms, robust feature capture for mesh cutting, and better local control for mesh refinement. Ideas will also be presented on how mesh modification can be used to extend and improve current meshing algorithms in pursuit of a general 3D hex mesher.

## References

- [1] S. Jankovich, S. Benzley, J. Shepherd, S. Mitchell, "The Graft Tool: An All-hexahedral Transition Algorithm for Creating a Multi-directional Swept Volume Mesh," *Proceedings, 8<sup>th</sup> International Meshing Roundtable*, p. 387-392, 1999.
- [2] G. Dhondt, "A New Automatic Hexahedral Mesher Based on Cutting," *International Journal for Numerical Methods in Engineering*, v. 50, p. 2109-2126, 2001.
- [3] M. Borden, S. Benzley, J. Shepherd, "Mesh Cutting: Fitting Simple All-hexahedral Meshes to Complex Geometric Features," *Proceedings of the 8<sup>th</sup> International Conference on Numerical Grid Generation in Computational Field Simulations*, p. 727-736, 2002.

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