Christopher Newman

Parallel Preconditioned Newton-Krylov solutions of the Laplace–Beltrami Target Metric (LBTM) smoothing method applied to three-dimensional unstructured meshes

Idaho National Laboratory
PO Box 1625
Idaho Falls
ID 83415-3840
christopher.newman@inl.gov
Glen Hansen
Benoit Forget

This presentation examines the performance of selected parallel, "physics-based" preconditioning methods applied to the Laplace–Beltrami Target Metric (LBTM) mesh smoothing equations. These equations constitute a nonlinear elliptic system of partial differential equations and are primarly used for unstructured mesh generation on complex geometry. When a target metric mesh improvement method is used, the three coordinate equations are coupled through the metric. The weak form of this system is solved using a standard Jacobian-free Newton–Krylov approach, employing the NOX, EPETRA and AZTECOO packages contained in Sandia National Laboratories TRILINOS project.

Historically the use of Laplace–Beltrami mesh generation methods have been limited by the scalability and efficiency of linear solvers. This work focuses on a study of the effectiveness and parallel scalability of selected "physics-based" preconditioners applied to this problem, and presents numerical examples to support this study and to provide for comparison of the preconditioning strategies.

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