Optimization Algorithm for Reference-Jacobian-Matrix Grid Generation

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In this talk we consider details of the numerical optimization algorithm we use in our optimization-based reference-Jacobian Matrix (RJM) method for grid generation([1], [2]). The goal of RJM grid generation is to create the grid whose Jacobian matrices are closest to specified RJM in a least-square sense. Our basic assumption is that if two maps have similar Jacobian matrices, and they agree on the boundary, then the maps themselves must be similar, and so will produce grids close to each other. For given RJM, the grid produced is a result of global optimization of a functional. This global functional includes a barrier that penalizes any grid which tends toward singularity.

Our attempts to apply standard constrained numerical optimization algorithms, [3], did not produce satisfactory results. Thus we have developed our own optimization algorithm employing a non-linear conjugate gradient method with a special line search algorithm. We will present 2D RJM examples on both structured and unstructured grids which demonstrate the robustness of our optimization algorithm.

References

[1] P. Knupp, L. Margolin, and M. Shashkov, *Reference Jacobian Optimization-based Rezone Strategies for Arbitrary Lagrangian-Eulerian*

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[2] M. Shashkov, and P. Knupp, Optimization-Based Reference-Matrix Rezone Strategies for Arbitrary Lagrangian-Eulerian Methods on Unstructured Grids, Proceedings of 10th International Meshing Roundtable, Newport Beach, CA, USA, October 7-10, 2001, pp. 167 – 176, (http://cnls.lanl.gov/ ∼shashkov),

[3] J. Nocedal and S. J. Wright, *Numerical Optimization*, Springer Series in Operations Research, Springer-Verlag New York Inc., 1999.