FINITE ELEMENT SUPG PARAMETERS COMPUTED FROM ELEMENT EDGE MATRICES FOR COMPRESSIBLE FLOWS

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Finite element computation of compressible flows rely on stabilized methods such as the Streamline-Upwind/Petrov-Galerkin (SUPG) formulation. Solution of the large, coupled nonlinear equation systems generated at every time step of a computation with high-resolution meshes require efficient algorithms. Therefore we need acceleration techniques such as local-time-stepping, element-based or edge-based data structures, adaptive time-stepping, and similar techniques.

In the SUPG formulation, selection of the stabilization parameter attracted a significant amount of research [1]. This parameter involves a measure of the local length scale, known as element length, and others parameters. Various element lengths were proposed. Recently, Catabriga, Coutinho and Tezduyar [2] proposed new ways of calculating the stabilization parameters for compressible flow problems. These parameters are calculated, based on the concepts described in [1], from the element-level matrices, and take automatically into account the local lengths scales.

In this work, we present how the calculation of the SUPG stabilization parameters from the element-level matrices is extended to the edge-based implementation. We also present how the concept of calculating from the element-level matrices a separate stabilization parameter for each degree of freedom, described in [1], is extended to computation of compressible flows.

References

[1] T. E. Tezduyar, Stabilization parameters and local length scales in SUPG and PSPG formulations, *Proceedings of the Fifth World Congress on Computational Mechanics*, Vienna, Austria. On-line publication: http://wccm.tuwien.ac.at/, Paper-ID: 81508.

[2] L. Catabriga, A.L.G.A. Coutinho and T.E. Tezduyar, Finite element SUPG parameters computed from local Matrices for compressible flows, In: *9th Brazilian Congress of Thermal Engineering and Sciences CD-ROM*, 2002, Caxambu, Minas Gerais, Brazil.