On the Performance of Fully-Coupled Algebraic Multigrid Preconditioning at Large-Scale: Application to FEM CFD/MHD

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ABSTRACT

Scientific understanding through computational simulation of fluid dynamics problems or problems governed by the resistive magnetohydrodynamics (MHD) equations often requires high resolution simulations and accurate and robust solution methods. Fully-coupled Newton-Krylov solution methods can be advantageous because of their robustness for complex multiphysics problems. However, they require the scalable solution of very large sparse linear systems. One approach that offers the potential of scalable solutions is a multilevel or multigrid approach. This study considers performance of a fully-coupled algebraic multigrid preconditioned Newton-Krylov approach [1-3] in the context of unstructured finite element methods. Scaling studies for CFD and resistive MHD test cases, including up to 524,288 cores on an IBM Blue Gene/Q platform, will be presented.

REFERENCES

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