Symmetric Solution in MHD

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M3D is a Multilevel, 3-dimension, parallel plasma simulation code, developed to study linear and non-linear MHD behavior of toroidal plasmas. We use an unstructured mesh and finite elements built on each poloidal plane. The key numerical requirement of the simulaton is to solve 3 types of elliptic equations with Neumann/Dirichlet boundary conditons on these planes, which consist of 13 equations and consume up to 90% of total cpu time. By introducing first order bases for the finite elments, linear systems are formed and their solutions are obtained by general GMRES and ILU preconditioner from the PETSc packages. As the available computer resources, the physics problem size and complexity keep increasing, scaling studies on today's key platforms show that the code needs to be optimized constantly. We have studied the original elliptic equations and found that their corresponding numerical systems can be formed in a symmetric way. This allows us to take advantage of the ICCG solver in the same package to greatly improve the code performance. The performance of this new symmetric solution will be reported.

To be presented as poster.

Work supported by U.S. DOE.