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Progress in Parallel Implicit Methods for Tokamak Edge Plasma Modeling[1] M. MCCOURT, Cornell U., L. CURFMAN-MCINNES, H. ZHANG, ANL, B. DUDSON, U. York, S. FARLEY, Ill. Inst. Tech., T. ROGNLIEN, M. UMANSKY, LLNL — Performance of prototype tokamak fusion devices depends sensitively on characteristics of the edge plasma between the hot core and surrounding walls. The edge plasma includes an especially wide range of physical time scales such that implicit numerical algorithms can substantially improve overall computational efficiency. Here some of the benefits and challenges of parallel implicit solution strategies are presented, with emphasis on preconditioned Newton-Krylov methods in the UEDGE and BOUT++ applications. Related multi-component issues are discussed in the context of the FACETS project, which is developing an integrated, parallel application to simulate physical processes from the material wall to the plasma core. It is demonstrated how this fusion research is motivating new capabilities in the PETSc equation solver library to better handle strong coupling between two or more distinct PDE-based mathematical models.

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