Abstract Submitted
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Development of the PARVMEC Code for Rapid Analysis of 3D MHD Equilibrium[1] SUDIP SEAL, STEVEN HIRSHMAN, MARK CIANCIOSA, ANDREAS WINGEN, EZEKIEL UNTERBERG, ROBERT WILCOX, Oak Ridge National Laboratory, ORNL COLLABORATION — The VMEC three-dimensional (3D) MHD equilibrium has been used extensively for designing stellarator experiments and analyzing experimental data in such strongly 3D systems. Recent applications of VMEC include 2D systems such as tokamaks (in particular, the D3D experiment), where application of very small (delB/B $\sim 10^{-3}$) 3D resonant magnetic field perturbations render the underlying assumption of axisymmetry invalid. In order to facilitate the rapid analysis of such equilibria (for example, for reconstruction purposes), we have undertaken the task of parallelizing the VMEC code (PARVMEC) to produce a scalable and temporally rapidly convergent equilibrium code for use on parallel distributed memory platforms. The parallelization task naturally splits into three distinct parts 1) radial surfaces in the fixed-boundary part of the calculation; 2) two 2D angular meshes needed to compute the Green's function integrals over the plasma boundary for the free-boundary part of the code; and 3) block tridiagonal matrix needed to compute the full (3D) pre-conditioner near the final equilibrium state. Preliminary results show that scalability is achieved for tasks 1 and 3, with task 2 still nearing completion. The impact of this work on the rapid reconstruction of D3D plasmas using PARVMEC in the V3FIT code will be discussed.

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