Summit Framework: Gyrokinetic calculations of ITG turbulence in general toroidal geometry*

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Abstract

The Summit Framework[1] is a gyrokinetic particle-in-cell turbulence simulation environment written in Fortran90 providing a unified object-based facility for sharing common components in a massively parallel setting. The Summit Framework is part of the US Department of Energy SciDAC Plasma Microturbulence Project. Work is under way to include kinetic electron models and electromagnetic effects[2], realistic magnetic geometry and global extent under one software environment. General geometry, realistic equilibria capabilities are being incorporated in the Summit Framework through the pg3eq_nc module, itself an extension of the circular geometry pg3eq module[3]. These modules use quasi-ballooning coordinates to solve the three-dimensional, toroidal, delta-f, gyrokinetic equations for ions in order to model ITG turbulence in the electrostatic limit with adiabatic electrons. Realistic geometry is introduced through an interface to data from the EFIT equilibrium code[4]. Massively parallel implementation has been effected using MPI. Successful nonlinear comparisons for a sample shaped and finite beta equilibrium have yielded equivalent results between serial, one-processor and multi-processor parallel implementations. Linear and nonlinear tests are currently under way between the general geometry and circular geometry modules with a circular equilibrium which can be accommodated in both modules. Results from all of these tests will be reported, along with progress in the upgrade of the interface to equilibrium data and in strategies for the global extension of both the circular and general geometry modules.

[1] http://www.nersc.gov/scidac/summit/
[2] Y. Chen, S. E. Parker, B. I. Cohen, A. M. Dimits, W. M. Nevins, D. Shumaker, V. K. Decyk, J. N. Leboeuf, "Simulations of turbulent transport with kinetic electrons and electromagnetic effects", Nuclear Fusion, Fusion **43**, 1121-1127 (2003). Online at stacks.iop.org/NF/43/1121
[3] A. M. Dimits, T. J. Williams, J. A. Byers, and B. I. Cohen, "Scalings of Ion-Temperature-Gradient-Driven Anomalous Transport in Tokamaks", Physical Review Letters **77**, 71-74 (1996).
[4] http://fusion.gat.com/efit/

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