2C54

Development of the kinetic adaptive MHD codes: AEGIS

L.-J. Zheng, M. Kotschenreuther

Institute for Fusion Studies, University of Texas at Austin, Austin, TX 78712

A. Turnbull

General Atomic, San Diego

Abstract

The principle object of current work is to develop a generalized MHD (AEGIS: Adaptive EiGenfunction Independent Solution) code with non conventional MHD effects included, such as plasma rotation, finite Larmor radius, wave-particle resonance, and energetic particle effects. These kinetic effects are often important in thin inertial layers, so a spatially adaptive solution procedure has been devised to be highly efficient on parallel architectures. Especially, it is intended to use the code to study the rotation effect on the ideal and resistive wall modes with the kinetic description of the compressibility term. With the parallel electric field and trapped particle effects included, the code can be also used to study the ST device. Our code follows some parts of philosophy of DCON by abandoning relaxation methods based on radial finite element expansion in favor of an efficient shooting procedure with adaptive gridding. The δW criterion is replaced by the shooting procedure and subsequent matrix eigenvalue problem. Since the technique of expanding a general solution into a summation of the independent solutions employed, the rank of the matrices involved is just a few hundreds. This eases the eigenvalue problem with non-ideal MHD effects. To include kinetic effects, the approach of solving for the distribution function as a local eigenvalue ω problem as in the GS2 code will be employed in the future. The ideal MHD version of the code: "AEGIS_mhd" has been developed. Benchmarking with existing major MHD codes: GATO, PEST, and DCON is in the progress. In constructing the vacuum code the following liquid metal wall is considered in collaboration with the APEX group in order to develop the liquid metal wall concept. Rotation effects will be included next, followed by FLR and full kinetc effects, noting that kinetic ion dissipation frequently determines MHD stability with FLR. The authors acknowledge various contributions for including the non-ideal MHD effects into the code from IFS theorists.