Contribution ID: **13** Type: **not specified**

Plasma / fusion physics 2: EMC3 etc.

Thursday 21 February 2013 09:40 (40 minutes)

The fluid model widely used for understanding plasma transport in the edge of magnetic confinement devices consists of a set of Braginskii's equations. Mathematically, they fall in the category of second-order partial differential equations of parabolic type. Numerical solutions of these equations for magnetically confined plasmas in realistic 3D geometry encounter the difficulty of dealing with highly anisotropic transport in rather complex magnetic field structures. Attempts of directly adopting conventional finite difference/element concepts can fail already when constructing a suitable computational mesh. The extremely high transport anisotropy necessitates field-aligned coordinates for a clean separation of the small cross-field transport from the much larger parallel one. In most of the practical 3D cases, where the fields usually exhibit a certain degree of stochastic behavior, it is very difficult to find a rule for ordering the stochastic field lines into a mesh acceptable by the conventional methods.
This paper presents a Langevin approach to this problem, which is valid for arbitrarily complex magnetic field structures. First of all, the fluid equations are rearranged, not only for adapting them to the Langevin scheme but also for reasons of numerical stability of the strongly coupled, non-linear system. A Monte Carlo procedure for integrating the Langevin stochastic equations is formulated locally over a finite field line, following a generalized Stratonovich definition. The field-lines required for transport alignment are interpolated from the pre-calculated ones stored on a 3D mesh by employing a reversible field line mapping technique. The toroidal component of the 3D mesh carries the full magnetic field information, while the choice of the other two components is left free from magnetic fields. All these techniques/methods are integrated into the EMC3 (Edge Monte Carlo 3D) code. As there is no limitation in magnetic structures, the code has been widely applied to magnetic confinement fusion devices, including a wide variety of tokamaks and stellarators. The paper gives a brief introduction to the EMC3 code and shows examples of some applications.

Presenter: FENG, Yuhe (IPP Greifswald)