

Numerical methods Used in Fusion Science Numerical Modeling

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The standard numerical methods used in simulation study of fusion plasma will be discussed[1]. Firstly, CFL condition for typical time-stepping schemes is explained using advection equation. Then finite difference scheme and spectral method are explained for simple PDE equations such as Hasegawa-Wakatani model. The boundary condition is also shown for finite difference scheme. Secondly, the fundamental parallelization method using MPI[2] will be shown for finite difference scheme and spectral method[3]. If time is allowed, numerical technique for PIC code[4] and related parallelization method will be explained in addition to some numerical libraries such as LAPACK, FFTW, PETSc and so on.

[1] "Computational Plasma Physics: With Applications to Fusion and Astrophysics", T. Tajima, Addison Wesley.

[2] "Using MPI-2", Advanced Feature of the Message-Passing Interface, W. Gropp, E. Lusk and R. Thakur, The MPI Press

[3] "Parallel Scientific Computing in C++ and MPI, A Seamless Approach to Parallel Algorithms and Their Implementation", G. E. Karniadakis and R. M. Kirby II, Cambridge.

[4] "Plasma Physics via Computer Simulation", C. K. Birdsall and A. B. Langdon, Taylor & Francis.