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TASK/TRを用いた乱流輸送モデルの比較とITERプラズマ輸送シミュレーション

Comparison of turbulent transport models and predictive transport simulation of ITER plasmas using TASK/TR

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In tokamak plasmas anomalous transport caused by turbulence is dominant for radial transport. Several transport models have been proposed to explain the turbulent transport. The strong non-linearity of turbulent transport models sometimes causes numerical instability in transport simulation, which is referred to as a stiff problem. Recently Pereverzev has proposed a numerical scheme which strongly improves the numerical convergence [1]. The purpose of this study is to examine several transport models including stiff ones by comparing the calculated temperature profiles with experimentally observed data. In our simulation of tokamak heat transport we use the TR module of the integrated transport analysis code TASK [2]. TASK is being developped in Kyoto University, and it has several modules to calculate phenomenon in fusion plasmas, such as transport, MHD equilibrium and wave propagation. In this study we calculate heat transport using TASK/TR coupled with the 2D MHD equilibrium analysis module TASK/EQ which solves Grad-Shafranov equation with fixed boundary. The TASK/TR module which assumes 1D diffusive transport modelling solves diffusion equations for densities, toroidal rotation, temperatures and a poloidal magnetic flux with respect to normalized radius ρ. The following five turbulent models, CDBM model [3] GLF23 model [4], mixed Bohm/gyro-Bohm model [5], MMM95 model [6] and MMM7_1 model [7] have been combined with TASK/TR. And also the numerical scheme proposed by Pereverzev has been implemented into TASK/TR in order to efficiently calculate with GLF23 and MMM models. Simulation results and their deviations of incremental energies and temperature for corresponding discharge data of large tokamaks obtained from the International Multi-tokamak Confinement Profile Database [8] will be presented. Based on the result of the comparison, predictive simulation results of ITER steady state plasma will be also presented.

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