Development of neoclassical transport database for LHD: DGN/LHD

A. Wakasa, S. Murakami [a], C.D. Beidler [b], H. Maassberg [b], M. Yokoyama [c], and S. Oikawa

Graduate School of Engineering, Hokkaido University, Sapporo 060-8628, Japan
[a] *Department of Nuclear Engineering, Kyoto University, Kyoto 606-8501, Japan*
[b] *Max-Planck-Institute für Plasmaphysik, EURATOM Ass., Greifswald, Germany*
[c] *National Institute for Fusion Science,322-6 Oroshi-cho, Toki 509-5292, Japan*

wakasa@fusion.qe.eng.hokudai.ac.jp

In helical systems, the neoclassical transport is one of the important issues in addition to the anomalous transport, because of a strong temperature dependency of heat conductivity and an important role in the radial electric field determination. Thus the development of a reliable tool for the neoclassical transport analysis is necessary for the transport analysis in LHD. We have developed a neoclassical transport database for LHD plasmas, DCOM/NNW[1,2]. The mono-energetic diffusion coefficients are evaluated based on the Monte Carlo method by DCOM code and the mono-energetic diffusion coefficient database is constructed using a neural network technique. The input parameters for the database are the collision frequency, the radial electric field, the minor radius and the configuration parameters ($R_{\rm axis}$, beta, etc). Recent increment of heating power raises the plasma temperature in LHD. Because the collision frequency decreases in proportion to $T^{3/2}$, we have to estimate the diffusion coefficient in the more collisionless regime. However, DCOM code requires huge calculation time to obtain the diffusion coefficient in such collisionless regime.

In this paper, we improve the DCOM code to reduce the computation time in order to obtain the mono-energetic diffusion coefficients in the more collisionless regime. As a result the DCOM calculation becomes about 6 times faster than previous version. Also we apply GSRAKE[3] which solves the ripple-averaged drift kinetic equation to obtain further collisionless regime. Finally we construct a neoclassical transport database DCOM-GSRAKE/NNW for LHD (DGN/LHD). The neoclassical transport analyses of high temperature LHD plasma are done using DGN/LHD.

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