4Pp30

無次元量入力ニューラルネットワークを用いたLHD プラズマの熱輸送モデリング

Modelling of heat transport in LHD using neural network with non-dimensional input parameters

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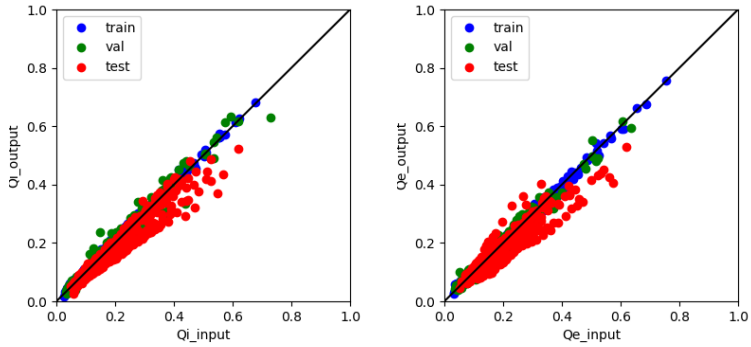
Integrated simulation codes have been developed for tokamak and helical plasmas to predict the plasma performance of the experiment devices and to design the future fusion reactor. TASK3D is an integrated simulation code for helical plasma and has been applied to the analyses of the LHD(Large Helical Device) plasma. We obtain relatively good agreements in the temperature and density profiles for the hydrogen NBI heating plasma between the TASK3D and experimental results[1,2].

We study modeling of heat flux using a neural network so that we can reproduce heat flux of a wider range of plasma parameter compare with the previous work. A code to predict the heat flux Q using a neural network (NN) has been developed in tokamaks[3]. In this study, we develop the transport model using NN to predict heat flux in LHD using the data which has been used in the previous paper[4]. We evaluate the model by taking $RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(Q_{NN} - Q_{exp})^2}$ on the test data.

As a result, we reproduce the heat flux with an RMSE of 0.029 on average for ion test data and 0.031 for electron. As sensitivity analysis, we verified how the output changes by increasing the value of the input parameter by 10 to 40%. We also show the role of input parameters in heat flux. As a result of the sensitivity analysis, the dependency of the variable in the gyro-Bohm model is not obtained with NN model. We will analyze important variables affecting heat transport by decreasing input variables and analyzing sensitivity.



(a) Ion results (b) Electron results

図 1: Regression plot comparing experimental results with NN results of ion and electron heat flux

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[4] M. Yokoyama, Plasma and Fusion Research **9** (2014) 1302137.