§25. Modeling of Integrated Core and Peripheral Plasma for DEMO


The aim of this collaborative work is that the development of the integrated simulation method on the control of the core and peripheral plasma for DEMO. For this aim, we carry out modeling on the critical physical issues on the control of the core and peripheral plasma for DEMO. In 2010, we focused on the following topics: (1) proposal and its critical issue on the control method for the core and peripheral plasma for the commissioning period for DEMO, (2) 1-D plasma modeling on the SOL-Divertor plasma to understand the stability and control of detachment in the divertor plasma, (3) improvement of modeling and code of the integrated core-peripheral plasma. Those results were presented in the domestic and international conferences shown in references.

As for the first topic, we firstly surveyed what kind of control method is required in a power plant based on the thermal and nuclear power plant. The inevitable control methods are controls of the rating operation, start-up operation, stop-down operation, and commissioning operation. Accordingly, we investigated the control method of plasma start-up operation including the commissioning operation for a tokamak fusion power plant. To propose the integrated control method for the core and peripheral plasma of the tokamak power plant, the analysis on MHD stability, current drive operation and divertor transport was carried out. Here, we proposed the ratio of tritium in the plasma of the tokamak power plant, the analysis on MHD transport code will be applied to the development of the integrated transport code. The following considerations were pointed out. The system code for the design activity is based on the 0 dimensional modeling. However, recent improvement of PC performance probably enables the system analysis based on the multi-dimensional modeling such as the equilibrium and MHD stability code. Furthermore, how collaborative alliance among the experimental study, the integrated modeling study, and the DEMO design study should be made was also discussed. Those important issues will be discussed in the following year.

Finally, we also discussed the standardization of the integrated transport code, and the way to apply it to the DEMO design activity. The following considerations were pointed out. The system code for the design activity is based on the 0 dimensional modeling. However, recent improvement of PC performance probably enables the system analysis based on the multi-dimensional modeling such as the equilibrium and MHD stability code. Furthermore, how collaborative alliance among the experimental study, the integrated modeling study, and the DEMO design study should be made was also discussed. Those important issues will be discussed in the following year.