S-R3-3

Prospects of Theory and Simulation Research in JAEA for IFERC-CSC

JAEAにおけるIFERC-CSCに向けた理論シミュレーション研究

Masatoshi Yagi
矢木雅敏[1,2)]

1)Japan Atomic Energy Agency, 2-166 Omotedate, Obuchi, Rokkasho-mura, Aomori 039-3212, Japan
日本原子力研究開発機構 〒039-3212 青森県六ヶ所村尾駮表舘2番166

2) Research Institute for Applied Mechanics, Kyushu University, 6-1 Kasuga-kouen, Kasuga, Fukuoka 816-8580, Japan
九州大学応用力学研究所 〒816-8580 福岡県春日市春日公園6-1

Theory and simulation research in JAEA for IFERC CSC is introduced. Firstly, the IFERC project in Rokkasho is explained briefly. Secondary, the NEXT project promoted by plasma theory and simulation group in JAEA is reported. Finally, the prospects of research for IFERC-CSC are discussed.

1. Introduction

IFERC (International Fusion Energy Research Center) is one of the projects of BA (Broader Approach), which consists of DEMO Design and R&D coordination center, CSC (Computational Simulation Center) and REC (ITER Remote Experimentation Center) in Rokkasho, Japan[1]. Based on the PA (Procurement Arrangement) created by F4E (Fusion for Energy) under the discussion with JAEA, the supercomputer will be provided to IFERC-CSC by French-owned computer company Bull[2]. It will be available to a scientific community of more than 1,000 European and Japanese fusion researchers for the next five years starting from January 2012. With a computational power above 1 petaflops, the supercomputer will be ranked among the most powerful system in the world and at least 10 times more powerful than any existing system dedicated to simulations in the field of fusion in Europe and Japan. The mission of IFERC-CSC is to exploit large-scale and high performance fusion simulations which contirubte to the fusion development(ITER & BA). The subjects of simulation research are plasma turbulence, fast particle physics, linear, nonlinear and/or extended MHD, edge physics, heating and current drive, integrated modelling, reactor materials and reactor technology and so on.

Up to now, our plasma theory and simulation group in JAEA has been promoted the NEXT (Numerical EXperiment of Tokamak) project[3], which is directed at understanding the complex properties of fusion plasmas and predicting the physical processes in the next generation of tokamaks, such as ITER, using recently advanced computer resources. To achieve our project, we are developing numerical simulation codes which are applicable for prediction of properties of the core plasma and the divertor plasma on equal footing. For core plasmas, the main interest is in the analysis of complex MHD and transport phenomenon. Simulation codes have been developed based on three models; a particle model, a fluid model, and a particle/fluid hybrid model, some of which are using the gyro-kinetic technique. Simulation codes for dense and cold divertor plasmas have been developed with particle and fluid models, combined with Monte Carlo techniques for neutrals and impurities. Such codes are executed on massively parallel computers. This project will be extended to obtain the theoretical basis for optimization and control of burning plasmas, effectively using IFERC-CSC supercomputer.

In this symposium, the prospects of fusion simulation research for BA IFERC-CSC will be discussed briefly based on the extension of NEXT project in JAEA.

References

[1] http://www.naka.jaea.go.jp/english/ba/index.html
[2] http://fusionforenergy.europa.eu/
[3] http://www-jt60.naka.jaea.go.jp/english/theory/index-e.html