5 - 15 Recent Progress in Reactor Physics Group at IMP

Gu Long, Fan Qin, Li Jinyang, Wang Dawei and Qin Changping

In 2014, some of achievements have been obtained in reactor physics group at IMP supported by the Strategic technology pilot projects of CAS.

The reactor physics group was one of the major groups involved in the MeAWaT project in PSI in Switzerland, whose aim will manufacture one single prototype nuclear fuel with minor actinide elements. In this project, our group has mainly focus on neutronics design and thermohydraulic analysis for the new type of nuclear fuel. During the work in this project, one new relationship for the pressure drop of wire-wrapped fuel bundles has been proposed. The comparison result between Cheng and Todreas' correlations has been showed as Fig. 1 as following.

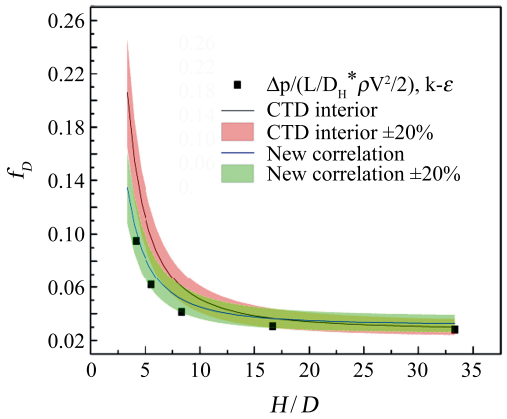

Fig. 1 (color online) Comparison of new correlation and Cheng and Todreas' correlations.

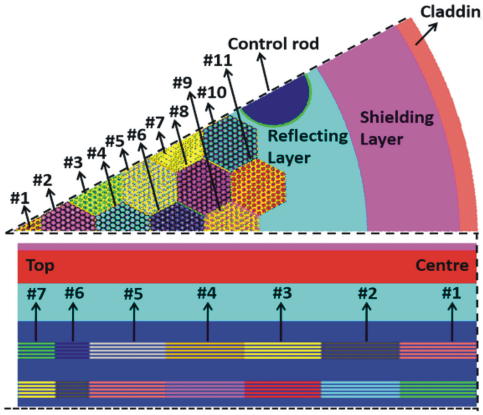

Fig. 2 (color online) 500MWth gas-cooled travelling wave fast reactor schematic.

In order to improve the utilization of uranium resources and decrease nuclear waste, a scheme of 500MWth Gas-cooled Travelling Wave Fast Reactor (GTWFR), as Fig. 2, has been designed. The 25 years burnup results show that GTWFR can use natural uranium or depleted uranium, with once-through cycle to improve the utilization of uranium resources and alleviate nuclear waste disposal pressure.

Reference

[1] S. Chen, N. Todreas, N. Nguyen, Nuclear Engineering and Design, 267(2014)109.

5 - 16 A New Relationship for the Pressure Drop of Wire-wrapped Fuel Bundles

Fan Qing and Gu Long

In the project of MeAWaT*, an innovative hollow pin is designed. For reactor design calculations, it is necessary to predict the hydraulic losses in multi-rod fuel bundles accurately[1]. And there is a long history for the use of spiral wire to maintain the pins in their position in fuel assemblies of reactors[2]. In this paper, a series of computational fluid dynamics (CFD) calculations are carried out on wire-wrapped pins, with constant pin length and different wire pitches. A new correlation is proposed.

The calculation region is built based on the geometry illustrated in Fig.1. The innermost pin and its surrounding hexagonal prism region are taken out as calculation region. In Fig. 1, there are two kinds of wire wrapped pins illustrated, one with a wire of one turn and the other with a wire of eight turns. Actually there are five kinds of wire-wrapped pins in this paper, the numbers of turns of which are one, two, four, six and eight respectively. The length of the pin keeps constant.

ANSYS Fluent† is applied to carry out the calculation. There are two kinds of fluid channels, one channel

*http://www.ccem.ch/science/meawat

†ANSYS Fluent Academic Research, Release 15.0