3-D Moderator Circulation Simulation of CANDU6 Nuclear Reactor Using CFX-4.3

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Abstract

3D CFD simulation for predicting the local subcooling of the moderator in the vicinity of the calandria tubes in a CANDU6 reactor is performed. For the current simulation, a set of grid structures with the same geometry as the Wolsong unit 2/3/4 moderator tank, called calandria, is generated and the momentum, heat and continuity equations are solved by CFX-4.3, a CFD code developed by AEA technology. The standard k-ε turbulence model associated with logarithmic wall treatment and SIMPLEC algorithm on the body fitted grid are used and Buoyancy effects are accounted for by the Boussinesq approximation. For the operating condition simulated in this study (103% full power), the flow pattern identified is the Buoyancy-dominated flow, which is generated by the interaction between the dominant Buoyancy force by heating and inertial momentum forces by the inlet jets. As a result, the velocity field and temperature distribution of a CANDU6 moderator in the operating condition are presented. The maximum temperature of the moderator is 90.3 °C, and the circulation pattern is reasonable.