CALCULATION OF PRESSURE DROP IN A NUCLEAR FUEL ELEMENT SPACER GRID

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Abstract. Previous results are extended to consider the influence of improved grid geometrical definition and resolution on the calculation of the pressure drop of the coolant flow past spacer grids in a preliminary design of a nuclear fuel assembly of a modular, integral PWR. The analysis considers one-twelfth cross section of the entire fuel element, despite a small asymmetry, and focuses on the influence on the results of well resolved boundary layers flow that may allow heat transfer analysis. A 3D CFD simulation is performed to estimate the pressure drop during steady state flow rate of single-phase light water at constant temperature. Based on the rapid flow development, as verified in the previous study, a shortened axial simulation domain is considered. The imposed symmetry and single-phase conditions eliminate bundle cross-flows. Appropriate boundary conditions are applied at fuel pin walls and symmetry planes, namely outlet absolute pressure and mass flow rate at inlet that are kept constant. The effect of turbulence models in connection with grid resolution is discussed. Heat transfer calculations are not attempted because of the lack of experimental data in the preformed experiment. However, grid resolution would permit such analysis. Results presented in non-dimensional, normalized way show the expected behavior with reasonable overall accuracy in the range of the spanned experimental conditions.

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