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# Thermal-hydraulic analysis of our modified annular fuel-based reactor design

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Abstract:
Our nuclear reactor design uses annular fuel which has a lot of good features and my work is to make a detailed study of the thermal-hydraulic features of our 110MWe marine nuclear propulsion reactor using COMSOL multi-physics.
As any other thermal hydraulic analysis this study, which is a part of a larger design of course, is meant to:
1. Determine the temperature distribution across the fuel.
2. Determine the coolant flow rate needed.
3. Determine the "Departure from Nucleate Boiling (DNBR)"and to ensure that the reactor is working within a certain limits.
4. Achieve high coolant temperature to improve the thermodynamic efficiency of the reactor
Due to limited computational power we chose to work on a rod-centred subchannel assuming that the energy is generated within the fuel and any other energy generated within the coolant is to be neglected.
After setting our model and testing it using our three benchmarks (westinghouse typical PWR, VVER-1000 and Kazimi's annular fuel) we are abel to use it to avoid our thermal-hydraulic limitations which are:
1. To avoid bulk coolant coiling and to ensure the stability of the coolant.
2. To assure that the MDNBR > 1.3 (to have a sufficient margin away from film boiling)
3. The fuel temperature will not exceed the melting point at anypoint in the fuel.
As well as in achieving our certain, prescribed, goals!

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