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Thermal Hydraulic Analysis of the IAEA 10MW Benchmark Reactor under Normal Operating Condition

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Abstract : The aim of this paper is to perform a thermal-hydraulic analysis of the IAEA 10 MW benchmark reactor solving analytically and numerically, by mean of the finite volume method, respectively the steady state and transient forced convection in rectangular narrow channel between two parallel MTR-type fuel plates, imposed under a cosine shape heat flux. A comparison between both solutions is presented to determine the minimal coolant velocity which can ensure a safe reactor core cooling, where the cladding temperature should not reach a specific safety limit 90 °C. For this purpose, a computer program is developed to determine the principal parameter related to the nuclear core safety, such as the temperature distribution in the fuel plate and in the coolant (light water) as a function of the inlet coolant velocity. Finally, a good agreement is noticed between the both analytical and numerical solutions, where the obtained results are displayed graphically.

Keywords : forced convection, pressure drop, thermal hydraulic analysis, vertical heated rectangular channel
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