



Iranian Journal of Physics Research, Vol. 24, No. 4, 2025
DOI: 10.47176/ijpr.24.4.61908

Neutronic and thermohydraulic analysis of annular fuels in MCNPX and ANSYS FLUENT for use in BNPP

Z TayyariSadegh ^{*1} and F Zolfagharpour¹

University of Mohaghegh Ardabili, Ardabil, Iran

E-mail: z.tayyari@uma.ac.ir

(Received 3 June 2024 ; in final form 7 September 2024)

Abstract

In this article, the use of annular fuel instead of solid fuel is investigated in the core of the Bushehr reactor. In annular geometry, the fuel has two internal and external channels and two surfaces for temperature exchange. The current solid fuel used in the Bushehr reactor and five types of annular geometries were simulated in the MCNPX.2.6.0 nuclear code. After validating the simulation, some neutronic parameters have been calculated by the code. By analyzing the results, the optimal annular geometry has been introduced and suggested. After the neutronic analysis, the chosen annular geometry has been analyzed from the thermohydraulic point of view in the COBRA code and FLUENT software. According to the obtained results, the use of annular fuel, the burnup increases by about 4.01 GWd/MTU. Also annular fuel usage decreases the maximum temperature of the fuel center by about 300 K. It also increases the safety margin of MDNBR from 1.7 in solid fuel, to 2.5 in the outer cladding, and to 3.7 in the inner cladding of annular fuel.

Keywords: annular fuel, BNPP, burnup, MCNPX, FLUENT

For full article, refer to the Persian section