Narodowe Centrum Badań Jądrowych
National Centre for Nuclear Research
ŚWIERK

Seminarium Zakładu Energetyki Jądrowej i Analiz Środowiska (UZ3)
Departament Badań Układów Złożonych (DUZ)

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Seminarium hybrydowe: **sala 172, bud. 39 (Cyfronet, III piętro)**

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Speaker: in person

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Neutronic and thermal coupled calculations for an HTGR pebble with discrete power generation using Serpent and OpenFOAM

Abstract:

The High Temperature Gas-cooled Reactor (HTGR) is characterized by a high output temperature and inherent safety due to its fuel design. However, the double heterogeneity of the reactor component structure poses a challenge in thermal analyses, where fuel temperature is a key safety parameter. During the seminar, a methodology for coupled thermal and neutron calculations with power discretization will be presented. The method is based on the point generation of power in the thermal model, and these points are determined based on the location of the fuel particles in the neutronic model. The fuel pebble model of the Very High Temperature Gas-cooled Reactor (VHTR) was used for development and verification of the method.

The multi-physics interface capabilities of the Serpent code were used to investigate several configurations of the thermal model mesh and its alignment with the fuel. The impact of the radial discretization of power density was further analyzed in detail. The study revealed that the highest accuracy in power discretization was achieved when the thermal model mesh was aligned with the TRi-structural ISO-tropic (TRISO) fuel particle size, and the TRISO particle arrangement was centered relative to the mesh cells. Moreover, it was found that due to the power-temperature feedback phenomena the power is shifted outwards, but only in range of 1% of the relative power.

Serdecznie zapraszamy
Tomasz Kwiatkowski, Mariusz Dąbrowski

Bio:
Dr inż. Michał Górkiewicz - is a specialist in coupled neutronic-thermal-hydraulic calculation at the Division for Nuclear Energy and Environmental Studies in the National Centre for Nuclear Research. His research is focused on thermal-hydraulic and neutronic analyses of High Temperature Gas-cooled Reactors using CFD and Monte Carlo methods.