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LOGOS CFD software application for the analysis of liquid metal coolants in the fuel rod bundles geometries

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Liquid metals (LM), such as sodium, lead or lead-bismuth eutectic (LBE), are preferred candidate coolants for advanced fast nuclear reactors next generation. Despite the comprehensive amount of experimental and calculated data, obtained by Russian as well as EU scientists in previous 30-40 years, the investigation of hydraulic and heat transfer characteristics of the fuel pin bundles is one of the key issue under the reactor design.

With the development of computing technologies, the investigation of thermal-hydraulic behavior of these coolants in the fuel-rod bundle geometries can be computed using commercial of in-house CFD software. As a result, a number of expensive full-scaled experiments with LM flows can be reduced.

The LOGOS CFD software was developed at the Russian Federal Nuclear Center - VNIIEF (Sarov, Russia) in a framework of the development of supercomputers and grid-technologies project. At present, validation and verification of the LOGOS in a framework of the new generation computation codes project is been performed in application to the LM flow simulation in the fuel pin bundles.

In this paper, the SST (Shear Stress Transport) k-ω model as well as combination of this model with turbulent heat transfer models, such as AKN and TMBF, released in the LOGOS in a framework of PRORIV project, is applied. Results of numerical simulations of the LBE flow around a heated rod in an annular cavity (THESYS project), sodium flow in the tightly packed parallel rod-bundle (TEGENA experiments) and LBE flow in the 19-pin hexagonal rod bundle with support grids (THINS project) are described.

Comparative analysis of experimental and calculated data obtained using both LOGOS software and ANSYS Fluent is given.

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