

Abstracts

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**Parallelization of Heterogeneous Reactor Calculations
on Graphics Processing Units**

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Parallelization of neutron calculations performed by heterogeneous method is realized on graphics processing unit. Parallel algorithm of modified TREC code is described. Efficiency of parallel algorithm is evaluated.

Key Words: Theory of Heterogeneous Reactor, Parallel Computing, CUDA.

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**The Integral Non-Stationary Equations of Neutron Transport
for Calculations of Nuclear Reactors Kinetics Using Monte Carlo Method**

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The integral equations for form-functions are given in adiabatic, quasistatic and improved quasistatic approximations. The approach to the solution of these equations by the Monte Carlo method is described.

Key Words: Neutron Kinetics, Integral Equation, Monte Carlo Method, Quasistatic Approach.

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Calculation Investigations of Heat Rate in Nitride and Metallic Nuclear Fuel Tested in the Reactor BOR-60

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The calculation investigations related to the determination of the delayed gamma emission contribution to the total heat rate in the experimental oxide nuclear fuel with different enrichment are performed using the method developed by the authors. It has been shown that the neglect of delayed gamma emission can lead to the significant underestimation of heat rate.

Key Words: Fuel Element, Experimental Fuel Assembly, Radiation Heat Rate, Gamma Quantum, Gamma Emission, Fission Products.

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The Calculation Research to Validate BN-800 NPP Parameters at Normal Operation Modes

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The results of calculation research of BN-800 NPP starting modes as the most representative ones for defining NPP operating conditions at normal operation are presented. The calculation analysis is carried out using TR-BN code. On the basis of the carried out calculation research, requirements and recommendations for the BN-800 start-up with two and three heat removal loops are defined. The main static BN-800 parameters in heat-rejection circuits needed to define NPP equipment operating conditions at various power levels and time intervals are calculated.

Key Words: Normal Operation Modes, Static Parameters, BN-800 NPP, TR-BN Code.

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Mathematical Model for 3D Temperature Field Calculation in RBMK Graphite Stack

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A short description of the mathematical model for 3D temperature field calculation in RBMK graphite stack is given. The results of steady-state and accidental regimes calculations are presented. Comparison with the results of the other codes is performed. Comparison with temperatures measured in the graphite column joints is performed too.

Key Words: Graphite Stack, Calculation Code, Graphite Temperature.

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Analysis of Features of Hydrodynamics and Heat Transfer in the Fuel Assembly of Perspective Sodium Reactor with a High Rate of Reproduction in the Uranium-Plutonium Fuel Cycle

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The fast sodium reactor fuel assembly (FA) with U-Pu-Zr metallic fuel is described. In comparison with "classical" fast reactor this FA contains thin fuel rods and wider fuel rod grid. Studies of the fluid dynamics and the heat transfer were carried out for such new FA design. The verification of the ANSYS CFX code has been provided for determination of the velocity, pressure and temperature fields in the different channels. The calculations in the cells and in the FA were carried out using the model of shear stress transport (SST) selected at the stage of verification. The results of the hydrodynamics and heat transfer calculations have been analyzed.

Key Words: Fast Breeder Reactor, Hydrodynamics, Heat Exchange, Verification, Beam of the FA, Heat Flow, Velocity Profiles, Temperature Fields, Turbulent Flow.

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The Kinetics of Fission Products Release from Microfuel Considering the Trapped Fraction and Limited Solubility Effects

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In this paper we studied the influence of trapped fraction and limited solubility effects on the release of Cs, Cd, Mo and Te from microfuel with TRISO coating. It was shown that these effects significantly affect the concentration profiles of fission products in microfuel. The influence of oxygen getter on cesium release from microfuel was studied. It was found that despite the anomalous behavior of cesium trapped fraction in microfuel without oxygen getter, difference in the integral release of cesium in microfuel with and without oxygen getter is not large if the observation time is not more than 920 days. Also we have shown that the release of Cd and Mo in microfuel with oxygen getter is slightly higher than without it. Tellurium release is practically independent of the presence of oxygen getter.

Key Words: Microfuel, Fission Products, Cesium, Solubility, Burnup, Diffusion.

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The Interdiffusion of Mo and W in the Shells of the Electrogenenerating Channels after Long In-Reactor Irradiation

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The article provides a detailed analysis of interdiffusion processes in the shells of the electrogenerating channels of the space reactors after long in-reactor irradiation. We study interdiffusion between Mo mono- and polycrystalline shells and the W layer of 10^{-4} m thickness at the exposure time of 3 000 to 12 350 hours and temperatures from 1 350 to 1 670 °C. We show one of the mechanisms, which contribute to pore formation and delamination of the W layer. This paper describes a method of calculating the activation energies, the temperature and the residual thickness of the W layer. It helps to predict shells structure until the long times from the beginning of the radiation.

Key Words: Reactor, Generation Channels, Shell, Microanalyzer, Interdiffusion, Activation Energy.

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About Harmonization of Deterministic and Probabilistic Approaches to the NPPs Safety Substantiation

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This work presents the practical realization of harmonious interaction between Deterministic and Probabilistic Safety Analyses based on the example of the estimation of the minimally sufficient quantity of Control Rods (CRs) in the Control and Protection System for WWERs with account of their plural sticking. A new conceptual approach to the definition of a minimum required quantity of CRs as part of the Spatial Effects Methodology is presented here on the basis of papers [1...3]. This work required usage of neutron-physical, thermal-hydraulic, probabilistic aspects and Philosophy of nuclear safety in their connection and

interdependency. Analysis is performed on example of the mode MSLB [4], which has the most dependence on EP with respect to any other accidents, with the up-to-date coupled code KORSAR/GP [5...7]. New approach allows solve a target task on the necessary CRs quantities assessment against of inter-competitive factors and with account of different uncertainties.

Key Words: Necessary CRs Quantities, Deterministic and Stochastic Methods, Safety, Response Surface, Extent of Conservatism, Uncertainties, PDFs.

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Investigation of Isomeric Ratios in Photofission Reaction on ^{235}U , ^{237}Np and ^{239}Pu

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Isomeric yield ratios for photofission fragments of ^{235}U , ^{237}Np and ^{239}Pu with end point energy of bremsstrahlung 18 MeV were measured. The new data for isomeric yield ratios for ^{131}Te , ^{132}Sb , ^{132}I , ^{133}Te , ^{134}I , ^{135}Xe nuclei were obtained from the calculations. The contributions to the isomeric yield ratios for given nuclide produced by β -decay from nuclei of parent isobaric chain were removed. Average angular momenta of studied nuclei were also determined by a statistical model analysis.

Key Words: Photofission, Method of Isomeric Ratios, Average Angular Momentum of Atomic Nuclei.