Abstracts
Journal "Problems of Nuclear Science and Engineering. Series: Physics of Nuclear Reactors", issue No.5, 2019

UDC 621.039.514.4

Accounting for Spatial Effects in Determining the Subcriticality Using Reactor Noise

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The possibility of reactor subcriticality determining based on spectral analysis of reactor noise taking into account spatial effects is considered. The proposed approach uses the model of an equivalent noise source, which in the accordance with Schottky formula, includes reactivity and neutron adjoint flux factors determined directly from reactor noise measurements by the system of incore detectors. The implementation of the methodology is illustrated by the example of a simple calculation model of a plane reactor.
Key Words: reactor noise, reactivity, spatial effects.

UDC 621.039.55

On the Issue of Stability and Safety of the Pulsed Neutron Source – Superbooster

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Highly intense pulsed neutron source can be made as superbooster, that is a powerful breeder of neutrons produced in accelerating proton target. Usually, superbooster is considered to be safe and reliable nuclear facility. However, as indicated in the paper, powerful superbooster can be less stable in operation than pulsed reactor. Therefore, problems of its safety call for close study.
Key Words: pulsed neutron source, neptunium-237, nuclear reactor, superbooster, kinetics, feedback of reactivity, subcriticality, nuclear safety.

UDC 621.039

Program Hortitsa-M. Convergence of Numerical Methods. Numerical Stability of Algorithm to Perturbation of Input Data

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The convergence of numerical methods used in the program Hortitsa have been reviewed. Results of numerical experiments confirm the stability of algorithms to pertrubation of input data.
Key Words: Hortitsa code, in-core detector, power distribution, VVER, current, measurement.

UDC 621.039.517

Calculation of the Temperature Distribution in a Heterogeneous Fuel Rod of a Nuclear Reactor

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The description of mathematical model for temperatures calculation in two-dimensional geometry verification data and an example of a two-dimensional calculation are presented in the article. As usual, temperature distribution in fuel rods calculation is based on the one-dimensional thermophysical model in cylinder geometry. In case of fuel rod with heterogeneous loading of fuel i.e. using of fuel pellets of different properties, part of which may not contain fissile material at all, required temperature distributions should be obtained from the solution of the heat conductivity equation, with distributed parameters both in axial and radial coordinates i.e. in two-dimensional *R–Z* geometry.

Key Words: equation, thermal conductivity, calculation, *R–Z* geometry, fuel rod, heterogeneity.

UDC 621.039.5

Modeling of the Fresh Fuel Isotopic Composition for VVER-type Reactors Based on Regenerated Uranium in the Framework of the STEM-NES Code for Conducting Scenario Studies of Nuclear Power Development

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This article presents the main features of the modules for the STEM-NES code, designed to calculate the equivalent isotopic composition of the fresh regenerated uranium fuel for VVER reactors. These calculation modules are based on modern enrichment schemes (single-cascade and two- cascade) which are capable to deliver the regenerated uranium of any quality. There are considered several examples of the calculation of the isotopic composition of the equivalent fresh regenerated uranium fuel for VVER-1200 and VVER-1000 reactors.

*Key Words***:** REPU, equivalent isotopic composition, SNF, regenerated uranium, VVER-1200, natural uranium consumption, nuclear fuel cycle, SWU.

UDC 621.039.577:537.58:53.023

A Mathematical Model of a Thermionic Converter in a Nuclear Reactor

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Currently, there is perform the work to create new thermionic reactors-converters. However, when designing an electrogenerating channel, difficulties arise in the complex description of the physical processes occurring in it. Moreover, empirical models of current-voltage characteristics don't always agree with the obtained results in the analysis of reactors experiments of an electrogenerating channels. This phenomenon is due to the fact that the empirical current-voltage characteristics are based on the experimental results of a specific electrode pair in a given mode of operation of the thermionic converter. The task undertaken in the report is to propose a complex mathematical model of a thermionic converter in a nuclear reactor. The mathematical model is based on solving the equations of transfer of charged particles, which take into account the features of all operating modes of the thermionic converter.

Key Words: thermionic converter, volt-current characteristics, electrode work surface function, electron cooling, electrogenerating element, thermionic reactor-converter, charged particle transport equations, interelectrode gap, low temperature plasma.

UDC 621.039.5

Control Features of Space Nuclear Power System in the Nominal Mode

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The paper discusses the problems of optimal control of a space nuclear power system (SNPS) in the nominal mode, which means the main mode of long-term (tens of thousands of hours) autonomous operation. The formation of optimization criteria and its implementation in the control strategy belong to the most important tasks of the prospective SNPS developer. The results obtained during the development of a multichannel control system for the thermoionic space nuclear power system "Yenisei" are described. A control strategy based on self-tuning is formulated, which allows achieving the specified optimization criteria when changing the parameters of the power plant during long-term operation.

Key Words: Space nuclear power system, long-term operation, automatic control, optimization.

UDC 621.039.5

Study of Technical and Economic Parameters of Double Cascade Scheme for the Enrichment of Multi-Recycled Uranium

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Results of optimization of the double cascade parameters for the enrichment of regenerated uranium with a high content of even isotopes are presented. In addition to the analysis of physical limitations, the analysis of the economic feasibility are also made. The method of choosing the optimal cascade parameters is proposed.

Key Words: double cascade, economy, enrichment, technique, uranium, isotope, gaseous centrifuge, separation cascade.

UDC 621.039.548

Destruction of Materials in the Process of Deformation by Stretching Samples in an Electron Microscope

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The results of studies of the material destruction in the areas in front of the top of the propagating microcracks are presented. The studies were performed on samples obtained by ion-point spraying and samples from structural materials of nuclear power plants obtained by thinning from a massive state. It is confirmed that in local areas located at the apex of a propagating microcrack, the material goes into an amorphous state before failure.

Key Words: micro crack, nuclear power systems, amorphous state, point defects, dislocations.

UDC 621.039.53

Methodology for Substantiating the Safety Concept "Leak Before Destruction" for VVER–Type Reactor Flange Connections

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The article contains a description of the method for estimating the implementation of the safety concept "Leak Before Break" (LBB) of flange connections of VVER-type reactors. The bases of the applied calculation models are described. Deterministic and probabilistic approaches to the calculation of criteria for the condition of the safety concept implementation are considered. The results of calculations are given as the example of the calculation of the circulation pump main connector.

Key Words: leak before break, flange connection, main circulation pump, VVER, probabilistic fracture analysis.