Abstracts
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Using of Backward Differential Formulas for Neutron Kinetic Equations.

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The neutron kinetic equations belong to the stiff equations for the numerical time integration schemes. This work deals with accuracy and performance of the backward differential formulas (BDF) and its implementation for the point and spatial neutron kinetics equations. The problems with a positive and negative reactivity insertion are considered applying the BDF method with automatic time step selection. The plots of numerical cost dependence of the local and global errors are presented. The results indicate that the BDF methods are effective for the nuclear reactors modeling.
Key Words: Neutron Kinetic, BDF, Automatic Time Step Selection Methods.

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For the Definition of the Lifetime of Prompt Fission Neutrons Using the Monte Carlo Method

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An algorithm of the prompt fission neutron lifetime calculation in a nuclear reactor with Monte Carlo method is described. The importance function estimation is implemented when the neutron transport equation is solved without the involvement of solving the adjoint neutron transport equation. The results of the prompt neutron lifetime calculation for some critical experiments are presented in compare with the experimental results.
Key Words: Nuclear Reactor, Kinetics, Monte Carlo Method, Importance Function, Prompt Neutron Lifetime.

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Calculation of the Neutrons Importance Function and the Effective Delayed Neutron Fraction Using the Monte Carlo Method

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This paper presents an algorithm of the neutron importance function and effective delayed neutron fraction calculating with Monte Carlo method which is realized in KIR program. The results of the effective delayed neutron fraction calculation for some critical experiments are presented in compare with the experimental results.
Key Words: Neutron Point Kinetics, Monte Carlo Method, Effective Delayed Neutron Fraction, Importance Function.

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Multilevel Net Hierarchy in Geometric Module of Monte Carlo Code MCU

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High-precision simulations of the pebble bed reactor requires effective multilevel modeling of geometry, it requires more level than usually used for conventional power reactors. The paper proposes the development of a geometric module for MCU code which solving such problems.
Key Words: Neutron Calculations, Multilevel Description of the Geometry, the Monte Carlo Method.

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Diffusion Coefficients for Finite-Difference Calculation Schemes of RBMK

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The methodology of diffusion coefficients preparation using precision MCU program for finite difference schemes with a single point to an RBMK cell is described. The basic stages of formation and verification of library of constants using this methodology are stated.
Key Words: RBMK-1000, Diffusion Coefficients, Diffusion Approximation, Computer Codes, Library of Constants, Precision Calculation, MCU Code.

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Beyond Design Blackout Accident in RBMK Modeling

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The modeling of the severe stage of the blackout accident in RBMK is performed. A special written code STEPAN-T is used. The code is based on the 3d model of the temperature field in the graphite stock calculation and the additional models describing the surrounding constructions. The behavior of the reactor on the severe stage without any mitigation measures is analyzed. Possible measures of the accident consequences softening are considered. A problem of the post criticality is discussed.
Key Words: Blackout, Severe Stage of Accident, 3d Model.

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Concerning Possibility of Monitoring of the Residual Power Release in Case of Severe Accidents

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Possibility of monitoring of the r*esidual power release in case of severe accidents on NPP is discussed.* Analysis of in-core control system detector signals is done in the context of r*esidual power* control of pressurized water reactor after shut-down.
Key Words: Severe Accident, Shut-Down Reactor, *Residual Power Release*, Control, Background SPD.

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Margin Factors in the Design of VVER Fuel Cycles

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The article describes methods of evaluation of margin factors currently used to estimate uncertainties of the VVER design parameters, which are calculated by created in NRC "Kurchatov Institute" software complex KASKAD. These margin factors are applied to the parameters of the reactor core restricted operating (design) limits during normal operation.

Key Words: Margin Factor, VVER Safety Assurance, Estimated Uncertainties of the Reactor Parameters.

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A Possible Mechanism for the Formation Nonwettable "Dry Spots" on the Heated Surface during Nucleate Boiling. Part I. Basic Models and Characteristics of Heterogeneous Nucleate Boiling in a Large Volume at Low Pressure

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The problems associated with the physics of heterogeneous boiling in large volume at low pressure on a flat horizontal surface are discussed. Examples of parametric mismatch trends associated with thermophysical properties and micro geometry wall surface, the size of the working area, a zone of influence of the growing bubble and the contact angle on the surface of liquid, solid and vapor phases are considered. The conclusion is done about the possible causes of ambiguity in the results of the simulation mode of nucleate boiling in a large amount in the calculation of the individual contribution of each of the mechanisms of heat transfer (convection, evaporation of liquid micro-layer thermal boundary layer and rebuilding after the separation of the bubble). It stressed the need to solve the problem in the 3D conjugate formulation.

Key Words: Heterogeneous Boiling, Micro Geometry Wall Surface, Contact Angle, Trigger CHF (Critical Heat Flux).

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Variants of Regenerated Fissile Materials Usage in Thermal Reactors |as a First Stage of the Fuel Cycle Closing

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Currently there is accumulated 240 000 tons of spent fuel (SF) in the world. Its long-term storage requires security and notable financial expenses that are increased each year. Obviously, it cannot continue for a long time and in the end it will be necessary make a final decision. At present time several variants of SF management are considered. Because of the main part of operating and under construction reactors are thermal reactors, it is clear that nuclear energy structure will stay the same in the nearest and middle term, so plutonium should be utilized in thermal reactors. In the study different strategies of SF management are compared: open fuel cycle with long-term SF storage; closed fuel cycle with MOX-fuel usage in thermal reactors and after long-term spent MOX-fuel; closed fuel cycle with heterogeneous fuel arrangement.

There is considered in details heterogeneous arrangement of fuel in the study. In case of traditional fuel it is necessary to reprocess whole volume of SF, in case of heterogeneous fuel there are possible to place ^{238}U and Pu separately. It is possible to achieve practically full burning of plutonium fission isotopes in fuel rods with plutonium loading. These fuel rods with burned plutonium may disposal after cooling without reprocessing. They will contain only several percentages of plutonium in compare with enrichment with

principally even isotopes. Fuel rods with ^{238}U should be reprocessing by usually way because of low level of burn up.
Key Words: SF Management, Radioactivity Minimization, Fuel Reprocessing, Heterogeneous Fuel, Plutonium Utilization, Closed Fuel Cycle

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Towards Determination of Reactor Jet Thrust Dimension and Energy Conversion Technique for a Nuclear Thermal Propulsion and Power

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Approach to choice of the optimal dimension of the reactor jet thrust and energy conversion technique for nuclear thermal propulsion and power (NTPP) is proposed taking into account allowable power production for the reactor and necessary specified reliability ground development tests. Reasonability of modular structure of the reactor and NTPP is considered on the basis of the results of design and ballistic analysis of the Martian expedition plan.
Key Words: Nuclear Reactor, Fuel Assembly, NTPP, Nuclear Thermal Propulsion, Nuclear Power System, IRGIT, Modularity, Heat Power, Power Production, Electric Power, Thrust.

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Degenerate Problems of Nuclear Power Optimization

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Optimization of the major systems of economy and power leads to degeneration of solution of high dimensionality. This is very strong mathematical complicating. However it allows considering the future development of power as teamwork of nuclear power plants (NPPs), power plants (PPs) on coal, PPs on gas. Besides, it allows considering development of power of the country only on NPPs. System optimization of parameters of NPPs is for this purpose necessary.
Key Words: Degenerate Optimization Problem, Economy, Power, Electric Power System, Power Plant, Nuclear Power Plant, an Optimality, Non-Optimality, Rate of Discounting.