Abstracts
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Development and Testing of a Model of a System Aimed at Catalytic Recombination of Radiolytic Gas Formed in a Fuel Solution of Research Nuclear Reactors

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There is developed a model of a system aimed at catalytic recombination of radiolytic gas (SKR) formed in a fuel solution of a homogeneous research nuclear reactor (IYaR). The model of SKR consists of a catalytic block, air compressor, air vapor condenser, IYaR above-fuel space simulator where there takes place accumulation of hydrogen-oxygen mixture and the systems of data registration with hydrogen, pressure and temperature sensors are applied. In the catalytic block there are used industrially prepared granular palladium catalysts as well as catalysts produced in RFNC-VNIIEF. There were performed the researches of efficiency of hydrogen-oxygen mixture catalytic recombination at a rate of its ingress equal to 0.45 dm^3/min and circulation rates of vapor-gas mixture in the SKR model equal to 4.5 и 9.0 dm^3/min depending on the number of catalytic segments in the catalytic block. There was determined the dynamics of hydrogen concentration variation ahead of and behind the catalytic block, pressure in the gas contour and temperature in the catalytic segments.

Key words: solution nuclear reactors, fuel solution radiolysis, system of hydrogen catalytic recombination, test-bench, catalytic block, palladium catalyst, catalytic utilization of radiolytic gas.

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On-Line Analysis of Power Fluctuations in Reactors with a Weak Source

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In the paper there are formulated approximate, simple in execution algorithms of solving a stochastic task for reactors with a weak source as applied to cases of step or linear reactivity insertion depending on time. The idea of limited or infinite (steady) fission chains applied before to reactor models with no delayed neutrons (DN) is taken as a basis of the algorithms formulated. In the given paper this approach is extended to reactor models considering DN. There are obtained analytical solutions for functions $P(m, t)$, $W(t)$ – probability distribution for a set of DN precursors «m» at time moment «t» and for the time of the first steady fission chain initiation, correspondingly, as well as for the average time of the first steady fission chain initiation t .

Radical simplification of the procedure of analyzing stochastic phenomena in reactors was achieved as a result of giving the approximate distribution shape $P(m, t)$ and through interpretation of Laplace transformation variable «p» as a free parameter which optimal value was determined basing on the comparison of the calculated and experimental value of t for pulsed reactor Godiva-II.

Key words: reactor with a weak source, reactor power fluctuations, algorithms of fluctuation analysis, limited or infinite fission chains, pulsed reactor Godiva-II.

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Radiolytic Boiling during Solution Homogeneous Reactor Operation in Static Mode

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The mechanism of radiolytic boiling in solution homogeneous reactors when operating in static mode is considered. It includes the birth of radiolytic gas bubbles on the tracks of fission fragments of uranium nuclei, their fusion and ascent. Using the experimental results, the dependences of the distribution over the height of the active zone of the number of gas bubbles and their sizes are analyzed.

Key words: solution reactor, static mode, radiolytic boiling.

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Complex Calculations of Solution Pulsed Nuclear Reactor VIR-2M

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There are presented the results of activities on the complex calculation of solution pulsed nuclear reactor (PNR) VIR-2M.

The results of fuel solution dynamics simulation are set out and different pulse modes realized on reactor VIR-2M are analyzed. At carrying out calculations there was for the first time taken into account the effect of cross-connections aimed at fixing rod channel position as related to the central channel of PNR VIR-2M.

The digital model of the PNR VIR-2M core vessel model is constructed and the analysis of its strain condition under pulse loads conditioned by fuel solution dynamics at fission pulse generation is performed. The undertaken researches make it possible to confirm mechanical and strength characteristics of the PNR VIR-2M vessel and substantiate its life properties.

Key words: reactor core, pulsed nuclear reactor, reactor dynamics, radiolytic boiling, fuel solution hydrodynamics, core vessel, neutron kinetics, fuel solution, vessel strength, strain condition.

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Dynamic Deformation Calculation of Reactor Br-K1M Blocks

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Within the framework of multifunctional program complex LOGOS there was performed numerical investigation of unsteady thermo-mechanical state of a fast pulsed reactor core under the effect of 600-μs fission pulse in terms of physical and geometric nonlinearity of the process of materials deformation, contact interaction and dependence of strength characteristics of fuel rings on temperature. In the paper there is for the first time investigated dynamics of structural reactor assemblies in the course of fission pulse evolution basing on 3d numerical simulation of dynamics of BR-K1M reactor components in software package LOGOS and further analysis of the blocks strain condition (SC) under unsteady (pulsed) homogeneous heating of fuel elements (FE). The analysis of results demonstrated that the shock contact interaction between functional assemblies of reactor in the pulsed mode of operation is missing. The results of simulation make it possible to substantiate regulated operating limitations of reactor BR-K1M.

Key words: fast pulsed reactor, fission pulse, fuel rings, strain condition, software package LOGOS.