Contribution ID: **369** Type: **Oral report**

NEUTRON-PHYSICAL CHARACTERISTICS ESTIMATION OF THE SUBCRITICAL ASSEMBLY "YALINA-THERMAL" WITHIN THE PHYSICAL BIRTH-AND-DEATH MODEL

Saturday, 25 September 2021 14:00 (25 minutes)

An analytical approach based on the birth-and-death model for description of the neutron and neutron-multiplying medium interaction process is presented in this work. It is called physical birth-and-death model [1]. Mathematical expressions of the multiplying medium main characteristics, reactivity ρ and average particles number at the time M(t), are given. These characteristics are estimated within obtained expressions for the subcritical assembly "Yalina-Thermal" with uranium fuel ^{235}U of 10% enrichment [2].
The physical birth-and-death model is a special case of the probability birth-and-death model (BDM). Neutron and neutron- multiplying medium interaction processes in a thermal nuclear reactor core were considered with linear growth approximation of the birth-and-death model in the E.A. Rudak works [3]. The radioactive particles decay processes properties within the framework of Poisson and binomial distributions were studied with BDM. The equations and fundamental curves describing multiplying medium parameters of the point thermal reactor example were analyzed by this model too. Nuclear assembly core is considered as ensemble of thermal point-reactors within birth and death model. This approach makes it possible to obtain the average values of the parameters that describe state of the system as a whole. The model is purely mathematical and operates intensities of birth (λ) and death (μ) concepts, but is not directly connected with the neutron multiplying medium parameters. Physical characteristics accounting is the next stage in the BDM development.
YALINA-Thermal is a subcritical assembly. It has been constructed at Joint Institute for Power and Nuclear Research –Sosny, Minsk, Belarus. The assembly together with the highly intensity neutron generator are used for neutrons static and dynamic properties research of accelerator-driven systems.

References:

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Session Classification: Section 3. Modern nuclear physics methods and technologies

Track Classification: Section 3. Modern nuclear physics methods and technologies.