CONTINUOUS SIGNAL-BASED NEUTRON NOISE AND MULTIPLICITY MEASUREMENTS - A NUCLEAR INNOVATION AWARD WINNER

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Abstract

Neutron fluctuations refer to phenomena that are consequences of the stochastic nature of the nuclear chain reaction. The most important practical application concerning reactor physics includes various neutron noise techniques and the neutron multiplicity counting technique used to determine fissile material content. A stochastic model of the signal of fission chambers has been developed in recent years, which showed that the quantities sought for in neutron fluctuation measurements could also be reconstructed from a continuous signal, excluding the dead time effect of overlapping detector pulses. The correctness of the theory and the practical applicability were proven for the first time by the consortium of the Budapest University of Technology (BME, Budapest, Hungary) and the Chalmers University of Technology (Gothenburg, Sweden) through simulations and measurements at the BME Training Reactor and the Kyoto University Subcritical Assembly (KUCA, Japan). These experiments also led to the development of a new, innovative measurement technology based on new principles, including instrumentation, data acquisition tools and techniques, evaluation methods and software, etc. This methodology has received the Nuclear Innovation Prize and is presented on the poster. The innovative methodology will open the way for the application of neutron fluctuation analysis in areas where the high source intensity and count rate prevented their use. That will allow these methods to significantly contribute to reactor safety and nuclear safeguards.

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