

Engineering Thermal-Hydraulic Simulator Based on Complex Simulation Suite “Virtual Unit of Nuclear Power Plant”

Authors : Evgeny Obraztsov, Ilya Kremnev, Vitaly Sokolov, Maksim Gavrilov, Evgeny Tretyakov, Vladimir Kukhtevich, Vladimir Bezlepkin

Abstract : Over the last decade, a specific set of connected software tools and calculation codes has been gradually developed. It allows simulating I&C systems, thermal-hydraulic, neutron-physical and electrical processes in elements and systems at the Unit of NPP (initially with WWER (pressurized water reactor)). In 2012 it was called a complex simulation suite “Virtual Unit of NPP” (or CSS “VEB” for short). Proper application of this complex tool should result in a complex coupled mathematical computational model. And for a specific design of NPP, it is called the Virtual Power Unit (or VPU for short). VPU can be used for comprehensive modelling of a power unit operation, checking operator's functions on a virtual main control room, and modelling complicated scenarios for normal modes and accidents. In addition, CSS “VEB” contains a combination of thermal hydraulic codes: the best-estimate (two-liquid) calculation codes KORSAR and CORTES and a homogenous calculation code TPP. So to analyze a specific technological system one can build thermal-hydraulic simulation models with different detalization levels up to a nodalization scheme with real geometry. And the result at some points is similar to the notion “engineering/testing simulator” described by the European utility requirements (EUR) for LWR nuclear power plants. The paper is dedicated to description of the tools mentioned above and an example of the application of the engineering thermal-hydraulic simulator in analysis of the boron acid concentration in the primary coolant (changed by the make-up and boron control system).

Keywords : best-estimate code, complex simulation suite, engineering simulator, power plant, thermal hydraulic, VEB, virtual power unit

Conference Title : ICPSS 2017 : International Conference on Power Systems and Simulation

Conference Location : Rome, Italy

Conference Dates : May 04-05, 2017