

Simulation in nuclear engineering design;

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Abstract

The development of a new system or process in nuclear field requires generally first to select structural material and coolant and identify associated critical issues, which are inherent in the design and safe operation of the system or process which has to be developed. The design of a system or process has to deal with neutronics, thermal hydraulics, mass and heat transfer, and their consequences on heat deposition, materials structure mechanics, coolant technologies, control systems and operational procedures. All these related studies, using analytical, numerical and experimental approaches, have the following main objective: assessment of reliability and safety aspects which might endanger the integrity and operability of the system, during the life duration; this assessment contributes to the definition and evaluation of control systems, countermeasures, and more generally the preparation of licensing. Selection of best design options requires the use of simulation tools in order to size the individual components and demonstrate the reliability of the whole system or process. Thanks to some examples, ie the design of a spallation target for nuclear waste transmutation, within the framework of an international project, we will illustrate the design strategy of a prototypical integrated system. An extension to some other specific fields of research in chemical engineering for nuclear applications will be performed.

Keywords: nuclear engineering, integrated prototypical systems, simulation tools