

# Methodology of Probability of Fuel Pin Failure for RIA Events

Ctibor Strmenský<sup>a)</sup>, Radoslav Zajac, Amine Bouhaddane,  
Slavomír Bebjak, and Miriama Lacková

*VUJE, a.s., Okružná 5, Trnava, 91864, Slovak Republic*

*<sup>a)</sup> Corresponding author: ctibor.strmensky@vuje.sk*

**Abstract.** The project TU\_RIA (request code: 09I01-03-V04-00083) was initiated with the aim of developing a methodology that will include software solutions for calculating the probability of fuel pin failure during RIA events. The RIA events are calculated by DYN3D - dynamic code. The objective of the methodology for mentioned purpose requires the creation of an ecosystem that includes software tools to ensure the intercooperation of DYN3D - dynamic code with TRANSURANUS - thermohydraulic code, that will provide a deeper knowledge into the analyzed parameters calculated using DYN3D - dynamic code that describes the processes associated with the RIA events (e.g.: Control assembly ejection). There is a certain probability of fuel pin failure, which must be analytically confirmed and quantified. This paper is focused on the methodology and includes a description of the ecosystem of all the software tools developed, their specifications, and their interconnections. The first group contains software tools for processing outputs calculated by the dynamic code (DYN3D). The software tools in this group ensure the extraction of all required parameters from the core. Once the complete data extraction is finished, the processing continues only with the data for selected assembly from the core, saving them into a file in a defined format using polynomial functions. The second group contains software tools for creating input file for calculation by the TRANSURANUS code. In this group, software tools process the extracted data for selected assembly from the core into a script format, which is then appended to the main body of the input file. The resulting file (inputfile) is used by the TRANSURANUS code. Before the actual calculation is performed by the TRANSURANUS code, the data is checked and the selected data is adjusted to the fuel pin. At this stage, the capabilities of the CALOPEA code are utilized to determine the mass flow in around of analyzed fuel pin more accurately. The third group contains software tools for processing outputs calculated by the TRANSURANUS code. This group are created for final evaluation of the failure rate of fuel pins. In this group, software tools ensure the processing of data on the number of times overpressure is reached for a defined number of variants and a defined range of variation for a parameter. During the calculation using the TRANSURANUS code, thermomechanical data on the fuel pin were also recorded. Therefore, the final evaluation also includes graphs showing thermomechanical changes in each axial layer of the fuel pin. The Python programming language will be used to create the necessary scripts (software tools).