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Sensitivity analysis of LOFT L2-5 test calculations

Andrej Prošek
Jožef Stefan Institute
Jamova cesta 39, SI-1000
Ljubljana, Slovenia
andrej.prosek@ijs.si

The uncertainty quantification of best-estimate code predictions is typically accompanied by a sensitivity analysis, in which the influence of the individual contributors to uncertainty is determined. The objective of this study is to demonstrate the improved fast Fourier transform based method by signal mirroring (FFTBM-SM) for the sensitivity analysis. The sensitivity study was performed for the LOFT L2-5 test, which simulates the large break loss of coolant accident. There were 14 participants in the BEMUSE (Best Estimate Methods – Uncertainty and Sensitivity Evaluation) programme, each performing a reference calculation and 15 sensitivity runs of the LOFT L2-5 test. The important input parameters varied were break area, gap conductivity, fuel conductivity, decay power etc. For the influence of input parameters on the calculated results the FFTBM-SM was used. The only difference between FFTBM-SM and original FFTBM is that in the FFTBM-SM the signals are symmetrized to eliminate the edge effect (the so called edge is the difference between the first and last data point of one period of the signal) in calculating average amplitude. It is very important to eliminate unphysical contribution to the average amplitude, which is used as a figure of merit for input parameter influence on output parameters. The idea is to use reference calculation as 'experimental signal', 'sensitivity run' as 'calculated signal', and average amplitude as figure of merit for sensitivity instead for code accuracy. The larger is the average amplitude the larger is the influence of varied input parameter.

The results show that with FFTBM-SM the analyst can get good picture of the contribution of the parameter variation to the results. They show when the input parameters are influential and how big is this influence. FFTBM-SM could be also used to quantify the influence of several parameter variations on the results. However, the influential parameters could not be identified nor the direction of influence. The results suggest that FFTBM is especially appropriate for a quick quantitative sensitivity analysis in which several calculations and/or influence of sensitive parameters need to be compared.

Keywords: *sensitivity analysis, FFTBM-SM, LOFT L2-5, thermal-hydraulic calculation, signal mirroring*