Reduced order modelling of the WWER-1000 reactor dynamics for fuel qualification

Y. Dubyk[1,2]

[1]IPP-CENTRE, 5B, Budindustrii Str. Kyiv 01013, Ukraine
[2]Karpenko Physico-Mechanical Institute of the NAS of Ukraine, 5, Naukova Str., Lviv, 79060, Ukraine

** Corresponding author email: dubyk-yr@ipp-centre.com.ua*

Nowadays, nuclear power plays a crucial role in the Ukrainian energy mix. Most of the Ukrainian units, built in Soviet era, now need a contemporary and effective fuel, but more important is supplier diversification. Fuel from any supplier should go through the extensive licensing program, which includes analysis during the dynamic events, like safe-shutdown earthquake and Large Breake LOCA. Such analysis could hardly be done using standard FE models, especially with solid elements, due to its complexity expecially is non-linear features of the reactor should be explored. On the other hand, we can propose a simpler and roubast approach, when reduced order modelling is applied and reactor is modeled in such a way, attention is paiyed to sagnificant non-linear features. The reactor components are replaced with corresponding mass/inertia representations, support elements are replaced with corresponding spring/damping characteristics, the model accounts for gaps and possible collision between the reactor pressure vessel internals. The main benefit of such model is obvious – time of calculation, which allow to analyse different seismic and dynamic transients. Moreover, if properly modelled, such analysis can easily identify the weak points in the structure and provide a fast estimation for the given dynamic event.

150_abstract