Contribution ID: **46** Type: **ORAL**

Development of an Artificial Neural Network for predicting spatial interdependencies of reactivity effects in Sodium Fast Reactors

Friday, 22 April 2022 10:42 (12 minutes)

Artificial Neural Networks (ANN) are presented as a very powerful tool for modelling complex systems. This approach is becoming increasingly widespread and it has a great potential for nuclear reactor applications. In this work, an ANN is developed for predicting sodium void effects in a large Sodium Fast Reactor core and their spatial interrelations.
The ultimate goal is to provide more realistic inputs to the thermal-hydraulics code TRACE for point-kinetics-based transient analysis of the most recent ESFR core conception. With that goal, an ANN is developed and trained to provide the global sodium density effect and Doppler effect, receiving as input the normalized sodium density and temperatures at the different regions of the core. Local reactivity effects are computed using ERANOS deterministic code for an extensive set of combined scenarios in order to train the ANN.
In this work, the main aspects regarding the optimization of the ANN are presented. A neuron trimming exercise is carried out for getting the most consistent architecture. The developed model can predict the reactivity evolution taking into account the mutual interdependencies of sodium void and Doppler effect. ANN' s performance is analyzed by comparing its output in a real transient simulated by TRACE with traditional approaches.

Country/Int. organization

Switzerland

Speaker's email address

jiri.krepel@psi.ch

Speaker's title

Mr

Affiliation/Organization

Paul Scherrer Institut

Primary authors: Mr JIMÉNEZ-CARRASCOSA1, Antonio (Politécnica de Madrid (UPM)); KREPEL, Jiri (Paul Scherrer Institut); Mr PONOMAREV, Alexander (Paul Scherrer Institut); MIKITYUK, Konstantin (Paul Scherrer Institut); Ms GARCÍA-HERRANZ, Nuria (Politécnica de Madrid (UPM))

Presenter: Mr JIMÉNEZ-CARRASCOSA1, Antonio (Politécnica de Madrid (UPM))

Session Classification: 6.5 Integrated Analysis and Digitalization

Track Classification: Track 6. Modelling, Simulations, and Digitilization