HIGH FIDELITY NUMERICAL SIMULATION OF A SINGLE PHASE PRESSURIZED THERMAL SHOCK

**Data:** czwartek, 09 lut 2017 - 10:00

**Miejsce:** PNT-NCBJ, sala 223 (Neutron)

**Prelegent i afiliacja:** dr Afaque Shams (Nuclear Research and Consultancy Group)

**Streszczenie:**

The integrity assessment of the RPV is considered to be an important issue for lifetime extension of nuclear reactors. A severe transient that can threaten the integrity of the RPV is the existence of a Pressurized Thermal Shock (PTS) during a Loss-of-Coolant Accident (LOCA). A PTS consists of a rapid cooling of the RPV wall under pressurized conditions that may induce the criticality of existing or postulated defects inside the vessel wall. The most severe PTS event has been identified by Emergency Core Cooling (ECC) injection during a LOCA. The injected cold water mixes with hot water present in the cold leg, and flows towards the downcomer, causing further thermal mixing and, therefore, large temperature gradients. This sudden change in temperature may induce high stresses in the RPV wall, leading to the propagation of flaws inside the vessel wall, especially in the embrittled region adjacent to the core. A proper knowledge of these loads is important for the RPV remnant lifetime assessment.

Traditional one-dimensional thermal-hydraulic system codes like RELAP-5 or CATHARE fail to reliably predict the complex three-dimensional thermal mixing phenomena in the downcomer occurring during the ECC injection. Hence, CFD can bring real benefits in terms of more realistic and more predictive capabilities. However, to gain trust in the application of CFD modelling for PTS, a comprehensive validation programme is necessary. In the absence of detailed experimental data for the RPV cooling during ECC injection, high fidelity DNS databases constitute a valid alternative and can serve as a reference for further development and validation of turbulence modelling approaches such as (U)-RANS and Hybrid LES/URANS models, which can eventually be used in engineering practice for the considered application.

However, performing a DNS for a realistic PTS scenario is extremely expensive and is not foreseeable in the near future. On the other hand, a high fidelity DNS database of a simplified PTS scenario will be very helpful for the scientific and engineering community. This can help in understanding the complex flow and heat transport in detail and can serve as a reference to validate low order CFD approaches, which eventually could be applied for realistic PTS scenarios. This seminar will focus on the route towards performing the DNS of a simplified single phase PTS.

Serdecznie zapraszam,

Mariusz Dąbrowski