Nuclear Reactor Technology
Education and research activities in 2015

SKC Symposium, October 8-9 2015

Jan Dufek
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Staff

Faculty Staff:
   Henryk Anglart, Prof., head
   Jan Dufek, Assistant Prof.
   Jean-Marie Le Corre, Affil. Faculty

Post-doc researchers:
   Haipeng Li, PhD

PhD students:
   Roman Thiele
   Reijo Pegonen
   Anders Riber Marklund
   Mattia Bergagio

Diploma work students:
   Boel Morenius (W., compl.)
   Jonathan Wäng (W., compl.)
   Jurij Kotchoubey (W., compl.)
   Lway Al-Maeeni (ABB, compl.)
   Karol Łuszczek (W.)
   Gustaf Holst (NRT)
   Börge Olsen (NRT)
   Aleix Fonellosa Caro (NRT)
Education: Courses

Thermal-Hydraulics in Nuclear Systems

6 ECTS
Course responsible: Henryk Anglart

Content:
- basics of thermodynamics, fluid mechanics and heat transfer
- two-phase flows
- critical heat flux
- critical flows
- thermo-mechanical interactions
- analysis of selected components
Education: Courses

**Nuclear Reactor Technology**

6 ECTS  
Course responsible: Henryk Anglart

Content:

- operation principles of nuclear power plants  
- design and analysis of reactor core  
- balance-of-plant analysis  
- estimation of safety margins  
- plant transient analyses  
- plant modeling with system codes
Education: Courses

Nuclear Reactor Dynamics and Stability

6 ECTS
Course responsible: Jan Dufek

Content:
- point kinetics and dynamics models
- reactivity feedbacks
- Doppler effect
- BWR stability
- core-wide oscillations
- regional oscillations
- two-phase flow instabilities
- density-wave instability

Out-of-Phase Oscillations (8)

The most dominant sub-critical mode \((m=1)\) is given as
\[
\phi_1(r, z, \theta) = J_1(3.83r / R)\sin(z / H)\sin \theta
\]
\(J_1\) - Bessel function of the first kind and first order

Fundamental mode
First sub-critical mode
Monte Carlo Methods and Simulations in Nuclear Technology

6 ECTS
Course responsible: Jan Dufek

Content:
- sampling procedures, error est., RNG
- general variance reduction techniques
- introduction to SERPENT and XS libraries
- analog MC simulations
- non-analog and criticality MC simulations
  - bias and convergence of the fission source
  - tallying procedures, geometry representation
  - variance reduction techniques
  - MC burnup and parallel calculations
Research: Topics

- **Henryk Anglart**: Development of experimental and computational methods for thermal-hydraulics in nuclear installations.
- **Jan Dufek**: Development of methods for MC neutronics and coupled simulations.
- **Haipeng Li**: CFD modeling of two-phase flow and heat transfer (NURESAFE, NORTHNET).
- **Roman Thiele**: Development of CFD methods and models (SKC) – *Detail presentation on Friday.*
- **Reijo Pegonen**: Development of new procedures for thermal-hydraulic simulations of the JHR (DEPTHS-JHR).
- **Anders Riber Marklund**: Development of methods for acoustic leak detection in sodium cooled systems (ALDESA).
- **Mattia Bergagio**: Experimental investigation of thermal mixing (SKC) – *Detail presentation on Friday.*
MSc:

Boel Morenius
Data acquisition and post-processing of a high time resolution local phase signal at the Westinghouse FRIGG facility

Jonathan Wäng
Validation of the Critical Flow Models in POLCA-T

Jurij Kotchoubey
POLCA-T Neutron Kinetics Model Benchmarking

Lway Al-Maeeni
Sub-cooled nucleate boiling flow cooling experiment in a small rectangular channel

PhD:

Roman Thiele (Dec 2015)
Mechanistic Modeling of Wall-Fluid Thermal Interactions for Innovative Nuclear Systems
Research: New journal publications


Research: New conference contributions


- **M. Bergagio**, Instrumentation for temperature and heat flux measurement on a solid surface under BWR operating conditions, In: Proceedings of the 16th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-16), 2015