TABLE OF CONTENTS

MONDAY, AUGUST 19, 2019, 1:30 P.M.

Computational Multi-Fluid Dynamics—I

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Dirk Lucas (HZDR), Jun Fang (ANL)

1A Multi-Scale Approach Simulating Generic Pool Boiling
T. Höehne, D. Lucas (HZDR)

14Numerical Simulations of Turbulent Rayleigh-Bénard Convection with a Free Surface
W. A. Hay (Université Catholique de Louvain), V. Deledicque (Bel V), M. V. Papalexandris (Université Catholique de Louvain)

29Towards Best Practice Guidelines for Euler-Euler Simulations of Poly-Disperse Bubbly Flows
D. Lucas, Y. Liao, R. Rzehak, E. Krepper (HZDR)

42Annular Flow Simulation Supported by Iterative In-Memory Mesh Adaptation
J. Fang (ANL), M. K. Purser (Univ of Colorado Boulder), C. Smith (RPI), R. Balakrishnan (ANL), I. A. Bolotnov (NCSU), K. E. Jansen (Univ of Colorado Boulder)

Benchmark Study of the Accident at the Fukushima Phase 2—I

Session Organizer: Marco Pellegrini (IPE)

Cochairs: Randy Gauntt (SNL), Terttaliisa Lind (PSI)

56Comparative Analysis of Core Degradation Models Between ASTEC and MELCOR. Application to the Fukushima Daiichi Unit-1 Like Accident
P. Drai, C. Bouillet, H. Bonneville, V. Topin, L. Laborde, S. Belon (IRSN)
Analysis for the Accident at Unit 1 of the Fukushima Daiichi NPS with THALES2/KICHE Code in BSAF2 Project

Hitoshi Tamaki, Jun Ishikawa, Tomoyuki Sugiyama, Yu Maruyama (JAEA)

Simulation of the Fukushima Daiichi Unit 2 Severe Accident with MELCOR 2.1

A. C. Morreale (CNL)

Analysis for the Accident at Unit 2 of the Fukushima Daiichi NPS with THALES2/KICHE Code in BSAF2 Project

Hitoshi Tamaki, Jun Ishikawa, Tomoyuki Sugiyama, Yu Maruyama (JAEA)

Computational Fluid Dynamics—I

Session Organizer: Jinyong Feng (MIT)
Cochairs: Elia Merzari (ANL), Jinyong Feng (MIT)

Predictive Study of Condensing Vapour Bubble in Subcooled Boiling Flow Using InterSection Marker Method

Syed Ahsan Sharif (UNSW), Mark Kai Ming Ho (ANSTO), Victoria Timchenko (USW), Guan Heng Yeoh (USW/ANSTO)

Applying Tet-to-Hex Meshing Method to Complex Nuclear Reactor Geometries for Spectral Element Code

Haomin Yuan, Elia Merzari, Yiqi Yu, Aleksandr Obabko (ANL), Mustafa A. Yildiz, Gerrit Botha, Yassin A. Hassan (Texas A&M)

Evaluation of Turbulence Modeling Approaches for the Prediction of Cross-Flow in a Helical Tube Bundle

Jinyong Feng, Michael Acton, Emilio Baglietto (MIT), Adam R. Kraus, Elia Merzari (ANL)

Fundamental Thermal Hydraulics: Experiments—I

Session Organizers: Guanghui Su (Xi’an Jiao Tong University), Xiaodong Sun (Univ of Mich)
Cochairs: Guanghui Su (Xi’an Jiaotong Univ), Jun Wang (Univ of Wisconsin, Madison)

Particle Decontamination in a Single Bubble During Pool Scrubbing

K. Fujiwara, Y. Nakamura, A. Kaneko, Y. Abe (Univ of Tsukuba)
160**Heat Loss Assessment for CHF Test Sections**

*Michael S. Bradbury (Information Systems Laboratory, Inc.)*

171**Observation of Air Bubble Characteristics by a Vertical Nozzle Under Pool Scrubbing Conditions**

*Jongwoong Yoon, Yong Hoon Jeong (KAIST)*

181**Thermal-Hydraulic Modeling of Supersonic Steam Injector as a Passive Safety System**

*Shuichiro Miwa, Nozomu Akiyama (Hokkaido Univ)*

**Thermal Hydraulics in Advanced Reactors: General—I**

*Session Organizers: Ferry Roelofs (NRG), Maria Avramova (NCSU)*

*Cochairs: Ferry Roelofs (NRG), Antoine Gerschenfeld (CEA)*

191**PIV Measurements Inside a Wire-Wrapped Hexagonal Rod Bundle: From Experiments to Governing Equations**

*F. Bertocchi, M. Rohde, J. L. Kloosterman (Delft Univ of Technol)*

205A **Collaborative Effort Towards the Accurate Prediction of Turbulent Flow and Heat Transfer in Low-Prandtl Number Fluids**


220**Thermal Hydraulic Design of an AcceleratorDriven Subcritical System for Burning Minor Actinides**

*Adam Kraus, Yan Cao, Elia Merzari, Yousry Gohar (ANL)*

234**Liquid Metal Thermal Hydraulics—Outcomes of the SESAME Project**

*F. Roelofs, A. Shams (NRG), A. Batta (KIT), V. Moreau (CRS4), I. Di Piazza (ENEA), A. Gerschenfeld (CEA), P. Planquart (VKI), M. Tarantino (ENEA)*

**Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—I**

*Session Organizer: Ferry Roelofs (NRG)*

*Cochairs: Jun Liao (WEC), Diego Castelliti (SCK)*

248**Immortal Experimental Loop at JAEA—Post-Process and Validation**

*N. Watanabe, H. Obayashi, T. Sugawara, T. Sasa, K. Nishihara (JAEA), D. Castelliti (Belgian Nuclear Research Centre)*
Steady-State and Transient Experiments in Mock-Up of J-PARC LBE Spallation Target System Using Mockup Loop “IMMORTAL”


The Importance of Phenomena Identification and Ranking Table in Lead Fast Reactor Development

Jun Liao, Richard F. Wright, Paolo Ferroni (Westinghouse), Tanju Sofu (ANL), Sung Jin Lee (Fauske & Associates, LLC)

Boiling and Condensation Fundamentals—1

Session Organizer: Byongjo Yun (PNU)

Cochairs: Jae Jun Jeong (PNU), Seoungmin Oh (GNFA)

Coupled Calculation of Bubble Departure Diameter and Frequency from Mechanistic Principles for Nucleate Boiling Applications

Marco Colombo, Michael Fairweather (Univ of Leeds)

Temperature Distribution Measurement During Quenching of High-Temperature Wall with a Falling Liquid Film

Tomio Okawa, Keisuke Yamagata, Koji Enoki (The Univ of Electro-Communications)

Experimental Investigation of Subcooled Flow Boiling and CHF at High Pressure Using High-Resolution Diagnostics

A. Kossolapov, B. Phillips, M. Bucci (MIT)

Enhancement of Pressurized Subcooled Flow Boiling CHF with Nano-Engineered Surfaces

C. Wang, O. Akinsulire, G. Su, B. Phillips, M. Rahman, M. Bucci (MIT)

BEPU Analysis and Challenges in Licensing

Session Organizer: Brian Woods (OSU)

Chair: Jinzhao Zhang (Tractebel Engineering S.A.)

Uncertainty in Calculations by KWU-MIX of Condensation in the Cold Leg and Downcomer During Pressurized Thermal Shock

Richard R. Trewin (Framatome GmbH)
How to Bring Conservatism to a BEPU Analysis

Vincent Larget (EdF)

Uncertainty Assessment of LOCA Scenario for TRACE Model Based on TRAC-M Input of PWR Reactor

Pawel Domitr, Mateusz Malicki (National Atomic Energy Agency PAA), Lap-Yan Cheng (BNL)

Validation of a BEPU Methodology Through A Blind Benchmark Activity at the PKL Test Facility

J. Freixa, V. Martínez-Quiroga, M. Casamor, F. Reventós (UPC), R. Mendizabal (CSN)

Operation and Safety of Existing Reactors: General—I

Session Organizer: Jovica Riznic (CNSC)
Chair: Brian Woods (OSU)

Analysis and Implementation of Design Extension Conditions at Czech NPPs and Contribution (DEC) at Czech NPPS and Contribution of DEC to Enhancement of Defence-in-Depth

P. Kral (UJV)

An Artificial Intelligence-Guided Decision Support System for the Nuclear Power Plant Management

Botros Hanna, Tran Cao Son (New Mexico State Univ), Nam Dinh (NCSU)

VIKTORIA Experiments Investigating the Filtering System in the Sump of a PWR After a Loss of Coolant Accident—Part I: Physical/Chemical Effects on Strainer Head Loss Evolution

G. Repetto, B. Migot, J. F. Trigeol (IRSN), V. Soltész (VUEZ as)

Using Innovation to Deliver the Nuclear Promise at Exelon


Verification and Validation: General—I

Session Organizer: Kim Kungdoo (KAERI)
Cochairs: Byoung Jae Kim (Chungman Natl Univ), Jean-Marie Le Corre (Westinghouse)

A Frequency Response Approach to Model Validation for the Compact Integral Effects Test Facility in Transform

Dane De Wet, Per F. Peterson, James C. Kendrick, Christopher Poresky (Univ of California, Berkeley), M. Scott Greenwood (ORNL)

BWR Fuel Bundle Lift Force Measurements, Modeling and Validation

F. Waldemarsson, J.-M. Le Corre, S.-Ö. Lindahl (Westinghouse), U. C. Bergmann, Y. Le Moigné (Westinghouse Electric Sweden AB)
Analysis of the Accuracy of Residual Heat Removal in Gen-IV Reactors

Jorge Yanez, Andreas Class (KIT)

CHF and Post CHF Heat Transfer, Flooding and CCFL—I

Session Organizer: Josh Kaizer (NRC)
Chair: Juliana Duarte (Virginia Tech)

Rod Bundle Post-CHF Heat Transfer Analysis at BWR Prototypical Conditions—Part 2: Heat Transfer Coefficient

J. P. Duarte (Virginia Tech), P. Yarsky T. Zaki (NRC)

Development of CHF Prediction Method Based on the Film Flow Model with Nucleate Boiling Entrainment

Yuki Narushima, Kenichi Katono (Hitachi)

Countercurrent Flows in Vertical Pipes Under Flooding at a Square Top End

Michio Murase, Koji Mishida, Toshiya Takaki (Inst of Nuclear Safety System, Inc.), Raito Goda, Takeyuki Shimamura, Akio Tomiyama (Kobe Univ)

MONDAY, AUGUST 19, 2019, 3:30 P.M.

Benchmark Study of the Accident at the Fukushima Phase 2—II

Session Organizer: Marco Pellegrini (Institute of Applied Energy)
Cochairs: Joy Rempe (Rempe & Associates), Martin Sonnenkalb (GRS)

Sandia National Laboratories’ Contribution to the OECD/NEA BSAF Phase II Project

N. Andrews, C. Facett, N. Bixler, D. Clayton, R. Gauntt (SNL)

Analysis of Fission Product Transport in Unit 3 of Fukushima Daiichi

L. Fernandez Moguel, T. Lind (PSI), A. Rydl (INSET s.r.o.)

Three Weeks Analysis of the Fukushima Daiichi Unit 3 NPP by the SAMPSON Code: Contribution to the BSAF-2 Project

M. Pellegrini, M. Naitoh (IAE)
Analysis for the Accident at Unit 3 of the Fukushima Daiichi NPS with THALES2/KICHE Code in BSAF2 Project

Jun Ishikawa, Hitoshi Tamaki, Tomoyuki Sugiyama, Yu Maruyama (JAEA)

**Computational Multi-Fluid Dynamics—II**

*Session Organizer: Igor A. Bolotnov (NCSU)*

*Cochairs: Thomas Hoehne (HZDR), Nadish Saini (NCSU)*

Computational Experiments to Characterize Bubble Formation and Movement in Waste Glass Foam Layer

Donna P. Guillen, Alexander W. Abboud (INL), Richard Pokorny (UCT Prague)

Towards a Two-Phase Flow All-Regime Model for Simulating Transitions from Dispersed to Stratified Regimes

E. V. Kuidjo Kuidjo, M. G. Rodio (CEA), R. Abgrall (Univ of Zürich), P. Sagaut (Aix-Marseille Univ)

Interface Tracking Simulations of Bubble Population Effects in PWR Subchannels

Joseph J. Cambareri, Igor A. Bolotnov (NCSU)

Interface Tracking Simulations of Droplet Interaction with Spacer Grids Under DFFB Conditions

Nadish Saini, Igor A. Bolotnov (NCSU)

Assessment of MIT Momentum Closure Relations to Developing, Bubbly Flow Regimes

Brian Casel, Emilio Baglietto (MIT)

**Computational Fluid Dynamics—II**

*Session Organizer: Jinyong Feng (MIT)*

*Cochairs: Philippe Bardet (George Washington University), Jianping Long (XJTU)*

Importance of Conjugate Heat Transfer Modeling in Transient CFD Simulations

Angel Papukchiev (GRS), Dmitry Grishchenko, Pavel Kudinov (KTH)

CFD Simulation of a Steam Generator U-Bend Region with Anti-Vibration Bars for the Investigation of Local Flow Behavior

D. Vivaldi (IRSN)
A Reduced Order Model Study for Single-Phase Natural Circulation Reactor Stability
Yousef M. Farawila (Farawila et al., Inc.)

Thermal Hydraulic CFD Validation for Liquid Metal Cooled 19-Pin Hexagonal Wire Wrapped Rod Bundle
A. Batta, A. Class (KIT)

Study on the Two-Phase Flow in Simulated LWR Fuel Bundle by CFD Code
Ayako Ono, Susumu Yamashita, Takayuki Suzuki, Hiroyuki Yoshida (JAEA)

Thermal Stratification Analysis in a Pool-Type Geometry
James Schneider, Mark Anderson (Univ of Wisconsin, Madison), Emilio Baglietto, Liangyu Xu (MIT), Zeyun Wu, Sarah Morgan (Virginia Commonwealth Univ), Matthew D. Bucknor, Matthew Weathered (ANL), Sama Bilbao y Leon (OECD NEA)

Experimental Study of Thermal-Hydraulic Performance of a Printed Circuit Heat Exchanger
Keyong Cheng (CAS/Univ of Michigan), Xiulan Huai, Jiangfeng Guo (CAS), Xiaodong Sun (Univ of Michigan)

Effect of Indirect Heating of Rod Bundle in Fuel Assembly Thermal Hydraulic Experiment on Local Heat Flux Measurement
Bin Han, Bao-Wen Yang (Delta Energy Group/Xi’an Jiatong Univ), Cen Wei, Yudong Zha (Xi’an Jiaotong Univ)

708 The Effect of Gas-Liquid Properties on Height of Disturbance Waves in a Vertical Annular Two Phase Flow

S. Mori (Kyushu Univ), H. Yoshida (JAEA)

715 Experimental Investigation on CHF of Water Flowing in Upward Tube from Subcooled to High Qualities

Bing Yang, Minfu Zhao (China Inst of Atomic Energy)

Thermal Hydraulics in Advanced Reactors: General—II

Session Organizers: Ferry Roelofs (NRG), Maria Avramova (NCSU)
Cochairs: Maria Avramova (NCSU), Angel Papukchiev (GRS)

724 The Prospect and Challenge of Nuclear Thermal-Hydraulic Safety Research

Ki-Yong Choi (KAERI)

738 The U.S. Nuclear Regulatory Commission Approach to Modeling and Simulation of Advanced Non-LWRs: Preparing for the Next Renaissance

Stephen M. Bajorek (NRC), invited

756 Power-Reactivity Feedback and Oscillations in NuScale Power Module

Yousef M. Farawila (Farawila et al., Inc.)

766 Thermal-Hydraulic Stability of the NuScale Reactor Concept

Yousef M. Farawila (Farawila et al., Inc.), Donald R. Todd (Farawila et al., Inc./PNNL), Bryan R. Hayden, Taylor N. Coddington, Hengliang Shen (NuScale Power, L.L.C.)

Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—II
Session Organizer: Ferry Roelofs (NRG)
Cochairs: Ferry Roelofs (NRG), Katrien van Tichelen (SCK)

782 Heavy Liquid Metal Thermal Hydraulic Progress in the MYRTE Project
F. Roelofs (NRG), K. Van Tichelen (SCK-CEN)

796 Inter-Wrapper Flow: LBE Experiments and Simulations
Julio Pacio, Markus Daubner, Thomas Wetzel (KIT), Heleen Uitslag-Doolaard, Akshat Mathur, Ferry Roelofs (NRG)

810 Validation of the System Thermal Hydraulics Code Athlet for the Simulation of Transient Lead-Bismuth Eutectic Flows
Angel Papukchiev (GRS), Clotaire Geffray (CEA), Dmitry Grishchenko, Pavel Kudinov (KTH)

823 Investigation of the Turbulent Pr Model and Segmentation Rule for LBE Turbulent Heat Transfer
Peiying Li, Yu Hongxing, Li Meifu, Du Sijia, Yan Mingyu, Liu Yu, Zhu Dahuan, Zhang He (Nuclear Power Inst of China)

Boiling and Condensation Fundamentals—II

Session Organizer: Byongjo Yun (PNU)
Cochairs: Seungjin Kim (Purdue Univ), Sung Joong Kim (Hanyang Univ)

836 Experimental Investigation of Seismic Vibration on Subcooled Boiling Flow
Yang Zhao, Zhuoran Dang (Purdue Univ), Jingyu Du (Purdue Univ/Tsinghua Univ), Mamoru Ishii (Purdue Univ)

850 Relaxing the Stiffness of Interfacial Friction in the Drift Flux Formulation of Two-Phase Flow

Yousef M. Farawila (Farawila et al Inc.), Daniel Tinkler (Framatome),

863 Evaluation of Stratified Condensation Models for a Slightly Inclined Tube Using ATHLET Code

Yu Zhang (Deggendorf Inst of Technol/Univ of Luxembourg), Amirhosein Moonesi Shabestary (HZDR/Dresden Univ of Technol), André Bieberle (HZDR), Uwe Hampell (HZDR/Dresden Univ of Technol) Stephan Leyer (Univ of Luxembourg)

876 High-Fidelity Simulations of Boiling

Akash Dhruv, Elias Balaras (George Washington Univ), Amir Riaz, Jungho Kim (Univ of Maryland)

Instabilities and Nonlinear Dynamics

Session Organizer: Brian Woods (OSU)

Chair: Amir Ali (UNM)

888 Preliminary Analysis of Measured Data from a Simulated BWR Fuel Assembly Undergoing Power and Flow Oscillations Representative of Anticipated Transient Without SCRAM Conditions

P. Yarsky, T. Zaki (NRC), J. P. Duarte (VT)

902 The Effect of Reactor Control Systems on BWR Stability Using Unique Plant Data

Carl Adamsson (Vattenfall Nuclear Fuel AB), David Palko, Thomas Smed (Forsmark Kraftgrupp AB)

Operation and Safety of Existing Reactors: General—II
**Session Organizer:** Jovica Riznic (CNSC)

**Chair:** Jae Jun Jeong (PNU)

910 **VIKTORIA Experiments Investigating the Filtering System in the Sump of a PWR After a Loss of Coolant Accident—Part II: Downstream Effects**

G.Repetto, B. Migot, C. Heib (IRSN), V. Soltész (VUEZ as)

924 **A Methodology for Predicting the Fouling of Steam Generators and Its Impact on Their Performance**

Thibaut Dupuy, Thomas Prusek, Fadila Oukacine (EdF), Marc Jaeger (Univ of Aix-Marseille), Marcel Lacroix (Univ of Sherbrooke)

938 **Modification of 37-Element Fuel Bundle for Recovering Thermal Margin**

J. H. Park, J. Y. Jung (KAERI)

945 **Develop of Calculation-Analytical Justification of Possibility of Increasing the Thermal Power of Reactor for Unit 4 of Rivne NPP to 101.5% Nnom. (up to 3045 MW)**

Oleksandr Mykhailenko, Oleksandr Mazurok, Vadym Ivanov (ESG Group), Yuriy Hubenya (SD Rivne NPP)

**Verification and Validation: General—II**

**Session Organizer:** Kim Kungdoo (Korea Atomic Energy Research Inst.)

**Cochairs:** Ik Kyu Park (Korea Atomic Energy Research Inst.), Linyu Lin (NCSU)

956 **Advanced Studies and Statistical Treatment for Sodium-Cooled Fast Reactor PIN Failures During Unprotected Transient Overpower Accident**
N. Marie (CEA), K. Herbreteau, A. Marrel, F. Bertrand (CEA)

**Benchmarking of RAMONA5-FA to Oskarshamn-2 Instability Event**

Daniel R. Tinkler, Cameron D. Myers (Framatome), Yousef M. Farawila (Farawila et al Inc.)

**Assessment of Smoothed Particle Hydrodynamics Methods for Simulating the External-Flooding Scenario**

L. Lin, Nam Dinh (NCSU), S. Prescott, H. Bao (INL), N. Montanari, R. Sampath (Centroid Lab)

**Uncertainty and Sensitivity Analysis of PSBT with ATHAS Subchannel Code**

Peichao Zhai, Bo Zhang, Jianqiang Shan (Xi’an Jiaotong Univ)

**CHF and Post CHF Heat Transfer, Flooding and CCFL—II**

*Session Organizer: Josh Kaizer (NRC)*

*Cochairs: Yong Hoon Jeong (KAIST), Juliana Duarte (VT)*

1006 **Rod Bundle Post-CHF Heat Transfer Analysis at BWR Prototypical Conditions—Part 1: Inverse Heat Transfer**

J. P. Duarte (Virginia Tech), P. Yarsky, T. Zaki (NRC), M. L. Corradini (Univ of Wisconsin, Madison)

1017 **Steady-State Flow CHFs with Various Tube Materials**

Soon Kyu Lee (Univ of New Mexico), Nicholas R. Brown (Univ of Tennessee, Knoxville), Kurt A. Terrani (ORNL), Youho Lee (Seoul National Univ)

1023 **Initial Entrained Fraction at Onset of Annular Flow**

Henryk Anglart (KTH)
TUESDAY, AUGUST 20, 2019, 7:20 A.M.

**Keynote Session—I**

**Session Organizer and Chair: Marco Pellegrini (IAE)**

1035 *Findings on Fukushima Daiichi NPP Severe Accident and Implication to SA Code Validation*

*Shinya Mizokami (Tokyo Electric Power Co.), invited*

**Keynote Session—II**

**Session Organizer and Chair: Yassin Hassan (TAMU)**

1048 *Best Practices for CFD Grade Experiments and Recent Developments in High-Resolution Measurement Techniques*

*Annalisa Manera, Victor Petrov (Univ of Michigan), invited*

**Keynote Session—III**

**Session Organizer and Chair: Matieu Martin (Terra Power)**

1061 *Liquid Metal Thermal Hydraulics: State-of-the-Art and Future Perspectives*

*F. Roelofs (NRG), invited*

**Keynote Session—IV**

**Session Organizer and Chair: Brian Woods (OSU)**
Scaling Analysis of Thermal-Hydraulic Integral Systems: Insights from Practical Applications and Recent Advancements

C. Frepoli (FPoliSolutions LLC)

TUESDAY, AUGUST 20, 2019, 8:20 A.M.

Computational Multi-Fluid Dynamics—III

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Dirk Lucas (HZDR), Joseph Cambareri (NCSU)

On Numerical Simulation of Flashing Flows

Yixiang Liao, Dirk Lucas (HZDR)

Preliminary Development of a Coarse-Mesh Sodium Boiling Model for OpenFOAM Based Mult-Physics Solvers

Stefan Radman, Carlo Fiorina, Andreas Pautz (EPFL)

Benchmark Study of the Accident at the Fukushima Phase 2—III

Session Organizer: Marco Pellegrini (IAE)

Cochairs: Dave Luxat (SNL), Mizokami Shinya (TEPCO)
Overview and Outcomes of the OECD/NEA Benchmark Study of the Accident at the Fukushima Daiichi NPS (BSAF) Phase II—Results of Severe Accident Analyses for Unit 1

L. E. Herranz (CIEMAT), Marco Pellegrini (IAE), T. Lind (PSI), M. Sonnenkalb (GRS), L. Godin-Jacqmin (CEA), C. Lópe (CIEMET), K. Dolganov (IBRAE), F. Cousin (IRSN), H. Tamaki (JAEA), T. W. Kim (KAERI), H. Hoshi (NRA), N. Andrews (SNL), T. Sevon (VTT)

Overview and Outcomes of the OECD/NEA Benchmark Study of the Accident at the Fukushima Daiichi NPS (BSAF) Phase 2—Results of Severe Accident Analyses for Unit 2

M. Sonnenkalb (GRS), M. Pellegrini (IAE), L. E. Herranz (CIEMAT), T. Lind (PSI), A. C. Morreale (CNL), J. Kanda (CRIEPI), H. Tamaki (JAEA), S. I. Kim (KAERI), F. Cousin (IRSN), L. Fernandez Moguel (CIEMAT), N. Andrew (SNL), T. Sevon (VTT)

Overview and Outcomes of the OECD/NEA Benchmark Study of the Accident at the Fukushima Daiichi NPS (BSAF) Phase 2—Results of Severe Accident Analyses for Unit 3

T. Lind (PSI), M. Pellegrini (IAE), L. E. Herranz (CIEMAT), M. Sonnenkalb (GRS), Y. Nishi (CRIEPI), H. Tamaki (JAEA), F. Cousin (IRSN), L. Fernandez-Moguel (PSI), N. Andrews (SNL), T. Sevon (VTT)

Main Findings, Remaining Uncertainties and Lessons Learned from the OECD/NEA BSAF Project

M. Pellegrini (IAE), L. E. Herranz (CIEMAT), M. Sonnenkalb (GRS), T. Lind (PSI), Y. Maruyama (JAEA), R. Gauntt, N. Bixler (SNL), A. Morreale (CNL), K. Dolganov (IBRAE), T. Sevon (VTT), D. Jacquemain (IRSN), J. H. Song (KAERI), H. Hoshi (NRA), Y. Nishi (CRIEPI), S. Mizokami (TEPCO)

Computational Fluid Dynamics—III

Session Organizer: Jinyong Feng (MIT)
Cochairs: Jinyong Feng (MIT), Donna Guillen (INL)
Direct Numerical Simulations of Low-Prandtl Turbulent Heat Transfer in Planar Impinging Jets

M. Duponcheel, Y. Bartosiewicz (Universite Catholique de Louvain)

A Parameterized Proper Orthogonal Decomposition Approach for Reduced Order Models

T. P. Grunloh, L. Calian (Univ of Illinois), S. Natesh, A. Patel, T. Wilson (Illinois Rocstar LLC)

CFD Simulation of Condensation Heat Transfer in Horizontal Tubes

Khalid Khasawneh, Yong Hoon Jeong (KAIST)

Numerical Simulation on Fuel Assembly Deformation Induced by Flow Redistribution with Code SATURNE

T. Xu, J. X. Han, J. Min (EDF China Center), M.-C. Gauffre, R. Denefle (EDF)

Computational Thermal-Hydraulics: General—II

Session Organizer: Mathieu Martin (TerraPower)

Cochairs: Bin Han (Xi’an Jiaotong Univ), Guojun Hu (ANL)

Les Investigation of Prandtl Number Effects over a Backward Facing Step and Consequences in Terms of Best Practice Guidelines for RANS

S. Buckingham, L. Koloszar, A. Villa Ortiz (von Karman Inst for Fluid Dynamics), Y. Bartosiewicz, G. Winckelmans (UCLouvain)

Numerical Simulation on LMR Molten-Core Centralized Sloshing Behaviors with Single/Multi-Phase Smoothed Particle Hydrodynamics Based on Novel Density Formulation

Young Beom Jo, Eung Soo Kim (Seoul Natl Univ)
1246 A 3D Model to Solve U-Tube Steam Generator Secondary Side Thermal Hydraulics with Coupled Primary-to-Secondary Side Heat Transfer

D. Vivaldi (IRSN)

1260 Development and Implementation of a 1-D FEM Compressible Flow Module in TRICORDER—A MOOSE-Based Multi-Physics Code

L. B. Carasik, V. Patel, S. Judd, P. Venneri (UNSC)

**Fundamental Thermal-Hydraulics: Experiments—III**

**Session Organizers:** Guanghui Su (Xi'an Jiao Tong Univ), Xiaodong Sun (Univ of Mich)

**Cochairs:** Caleb Brooks (Univ of Illinois), Nesrin O. Cetiner (ORNL)

1275 Experimental Study of Gas-Liquid Two-Phase Flow Behavior with Steam Condensation During Pool Scrubbing

Yuki Nakamura, Kota Fujiwara, Akiko Kaneko, Yutaka Abe (Univ of Tsukuba)

1288 A New Dataset with Local Measurement and Visualization of Subcooled Boiling in an Internally Heated Annulus Channel

Joseph L. Bottini (Univ of Illinois), Longxiang Zhu, Zhiee Jhia Ooi, Taiyang Zhang, Caleb S. Brooks (Univ of Illinois)

1299 Relative Motion Between Phases in Horizontal Gas Dispersed Flow

Ran Kong (Purdue Univ), Jiawei Bian (Purdue Univ/Xi'an Jiao Tong Univ), Qingzi Zhu, Mamoru Ishii, Seungjin Kim (Purdue Univ)

1313 Experimental Study of Liquid Entrainment in ADS-4 Branch Tube with Double-End Inlets of Air-Water

Liu Wang (Xi'an Jiaotong Univ), Lifang Liu (State Power Investment Corp. Research Inst), Ning Wang (Xi'an Jiaotong Univ), Qionghua Sun (State Power Investment Corp. Research Inst), Kui Zhang (Xi'an Jiaotong Univ), Xiaoliang Fu (State Power Investment Corp. Research Inst)
Thermal Hydraulics in Advanced Reactors: General—III

Session Organizers: Ferry Roelofs (NRG), Maria Avramova (NCSU)

Cochairs: Steve Bajorek (NRC), Ki Yong Choi (KAERI)

1323 Printed Circuit Heat Pipe Heat Exchanger for Passive Containment Cooling System
Hae-Yong Jeong (Sejong Univ), In-Sik Ra (Energy Hub)

1332 PANAS- Project: Heat Transfer Model Development for Passive Safety Systems
Stephan Leyer (Deggendorf Inst of Technol/Univ of Luxembourg), Uwe Hampel (HDZR/Dresden Univ of Technol), Christoph Schuster, Wolfgang Lippmann (Dresden Univ of Technol), Markus Walther (Framatome GmbH), Kai Kosowski (PreussenElektra GmbH)

Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—III

Session Organizer: Ferry Roelofs (NRG)

Cochairs: Graham Kennedy (SCK), Alessandro Del Nevo (ENEA)

1346 Fouling Effect of Lead Oxide Crystallization on Heat Transfer in LBE
Yong-Hoon Shin, Kristof Gladinez, Jun Lim, Alessandro Marino, Kris Rosseel, Alexander Aerts, Katrien Van Tichelen (SCK-CEN)
Development of a Numerical Framework to Model Flow Accelerated Corrosion in a Lead Loop

Khaled Talaat, Rubel Das, Brian Romero, Cemal Cakez, Osman Anderoglu, Sang Lee (Univ of New Mexico), Youho Lee (Seoul Natl Univ), Heng Ban (Univ of Pittsburgh), Keith Woloshun, Seung Jun Kim, Dasari Rao, Cetin Unal (LANL)

Boiling and Condensation Fundamentals—III

Session Organizer: Byongjo Yun (Pusan National Univ)

Cochairs: Hyoung Kyu Cho (Seoul National Univ, SNU), Marco Colombo (Univ of Leeds)

Image Analysis of Bubbling Mode Condensation Oscillations in Horizontal Sparger

Elina Hujala, Vesa Tanskanen, Giteshkumar Patel, Juhani Hyvärinen (Lappeenranta-Lahti Univ of Technol)

A Potential Solution for Boiling Crisis

Prem Bikkina, Sushobhan Pradhan (Oklahoma State Univ)


Lior Nahon (NRCN/Ben-GurionUniv), Tali Bar-Kohany (NRCN/Tel Aviv Univ), Evgeny Rabinovich (NRCN), Yosef Aharon (NRCN/Ben Gurion Univ

Current Capability of Interfacial Area Transport Equation in Subcooled Boiling

Longxiang Zhu (Univ of Illinois/Xi’an Jiaotong Univ), Zhiee Jhia Ooi, Caleb S. Brooks (Univ of Illinois)

Operation and Safety of Existing Reactors: General—III

Session Organizer: Jovica Riznic (CNSC)
**Cochairs: Dan LaBrier (ISU), Amir Ali (UNM)**

1416**Integral Effect Tests in Visualization Basis 3D Printed Test Facility for Improved Applicability of Innovative Technologies**

*Kyung Mo Kim, In Cheol Bang (UNIST)*

1427**Development of Operation Strategy and Recovery Guideline During Extended Station Blackout for OPR1000 and APR1400**

*Chang Gyun Lee, Jae Min Park, Ho Bin Yim, Chan Eok Park, Gyu Cheon Lee (KEPCO E&C)*

1438**Thermal-Hydraulic Calculations and Development of Boundary Conditions for Assessing the Technical Condition and Life Time Extension of Primary Main Equipment for Reactor Facility KHNPP-1**

*Oleksandr Mykhailenko, Oleksandr Mazurok, Vadym Ivanov (ESG Group)*

1452**Feasibility Study of TES Integrated Nuclear Power Plant**

*Ju Yeon Lee, Jeong-Ik Lee (KAIST)*

**Verification and Validation: General—III**

**Session Organizer: Kim Kungdoo (KAERI)**

**Cochairs: Richard Schultz (ISU), Linyu Lin (NCSU)**

1462**Two-Fluid Equation Considering Time-Dependent Change of Fluid Volume**

*Jong Hyuk Lee, Kyung Doo Kim (KAERI), Byoung Jae Kim (Chungnam National Univ)*
1473 Establishment of Guideline for Credibility Assessment of Nuclear Simulations in the Atomic Energy Society of Japan

Masaaki Tanaka (JAEA), Yoshiro Kudo (CRIEPI), Kotaro Nakada (Toshiba Energy Systems and Solutions Corp.), Seiichi Koshizuka (Univ of Tokyo)

1485 Development of a One-Dimensional Model for a Closed Thermosiphon for Cooling a Spent-Fuel Pool

Richard R. Trewin (Framatome GmbH)

**CHF and Post CHF Heat Transfer, Flooding and CCFL—III**

**Session Organizer: Josh Kaizer (NRC)**

**Cochairs: Piyush Sabharwall (INL), Jean-Marie Le Corre (Westinghouse)**

1498 Development of Nuscale Critical Flux Correlations

A. Galimov (NuScale Power LLC), M. Bradbury (Information Systems Laboratories, Inc.)

1509 Modeling and Validation of a Post-Dryout Heat Transfer Model for Three-Field Sub-Channel Analysis

J.-M. Le Corre (Westinghouse Electric Sweden AB)

1528 Experimental Research of Critical Heat Fluxes on 37-Rod Bundles with Various Types of Intensifying Grids

D. Oleksyuk, D. Kireeva, L. Kobzar (NRC “Kurchatov Inst”)

1542 Validation of Cathare 3D Module on LSTF Core

Raphaël Préa (CEA)

**TUESDAY, AUGUST 20, 2019, 10:20 A.M.**
Computational Multi-Fluid Dynamics—IV

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Marco Colombo (Univ of Leeds), Ed Koman

1555 High-Fidelity Simulation of a Taylor Bubble in Co-Current Turbulent Flow
B. Mikuz (NRG/Jozef Stefan Inst), E. M. A. Frederix (NRG), I. Tiselj (Jozef Stefan Inst), E. M. J. Komen (NRG)

1569 Benchmarking of CFD Modelling Closures for Two-Phase Turbulent Bubbly Flows
Marco Colombo (Univ of Leeds), Roland Rzehak (HZDR), Michael Fairweather (Univ of Leeds), Yixiang Liao, Dirk Lucas (HZDR)

1583 CFD Simulations of Direct-Contact Condensation of Horizontal Vapor Jets
T. Pättikangas, J. Peltola, V. Hovi (VTT Technical Research Centre of Finland Ltd), M. Puustinen, A. Räsänen, E. Kotro (Lappeenranta-Lahti Univ of Technol)

1597 An Eulerian-Eulerian CFD Approach to Simulate the Themohydraulics of Pipes; Channels or Rod Bundles: From Onset of Nucleate Boiling to CHF
Wei Ding (HZDR/TU Dresden), Eckhard Krepper (HZDR), Uwe Hampel (HZDR/TU Dresden)

Benchmark Study of the Accident at the Fukushima Phase 2—IV

Session Organizer: Marco Pellegrini (IAE)

Cochairs: Marco Pellegrini (IAE), Didier Jaquermain (IRSN)
Uncertainty Analysis of Corium Relocation to the Lower Plenum Using Results from the OECD/NEA BSAF Phase II Project

Lucas I. Albright, Nathan Andrews, Larry Humphries, Randall O. Gauntt (SNL), Tatjana Jevremovic (Univ of Utah)

Reconstruction of the Fukushima Source Term from Nearby Radiological Measurements

Martin Sogalla, Martin Sonnenkalb, Sebastian Band, Cornelia Richter (GRS)

Analyses of Fission Products Behaviour and Environmental Releases During the Fukushima-Daiichi Accident by Direct and Inverse Approach at IRSN

Frédéric Cousin, Hervé Bonneville Charlaine Bouillet, Damien Didier, Didier Jacquemain (IRSN)

Outline of the OECD/NEA/ARC-F Project

Toru Nakatsuka, Toshikatsu Maeda, Tomoyuki Sugiyama, Yu Maruyama (JAEA)

Computational Fluid Dynamics—IV

Session Organizer: Jinyong Feng (MIT)

Cochairs: Bao-Wen Yang (XJTU), Matthew Zimmer (NCSU)

A Novel Coarse-Grid Sub-Channel CFD for Nuclear Thermal Hydraulics

B. Liu, S. He (Univ of Sheffield), C. Moulinec (Science and Technology Facilities Council), J. Uribe (EDF Energy R&D UK Center)

CFD Studies of Effect of Fuel Channel/Stringer Eccentricity in the Core of an Advanced Gas-Cooled Reactor

Jundi He, Shuisheng He (Univ of Sheffield), Bing Xu (EDF Energy)

CFD Analysis on Mixing Vane Grid Performance in a 5x5 Rod Bundle
Computational Thermal Hydraulics: General—III

Session Organizer: Mathieu Martin (TerraPower)

Cochairs: Sofiane Benhamadouche (EdF), Thomas Hoehne (HZDR)

1698 Reynolds-Averaged Turbulence Modeling Using Deep Learning with Local Flow Features

Chih-Wei Chang (Emory Univ), Jun Fang (ANL), Nam T. Dinh (NCSU)

1712 Numerical Simulation of Nonlinear Bubble Phenomena in Subcooled Boiling in a Channel

Jyoti Bhati, Swapan Paruya, J. Naik, L. G. Mayur, B. Das (NIT Durgapur), Subhramaniam Pushpavanam (ITT Madras)

1726 CFD-DEM Analysis of Realistically Heated Pebble Bed Geometry

Robert Mardus-Hall, Guan Heng Yeoh (Univ of New South Wales), Mark Ho (ANSTO)

1740 Hypothetical Accident Analyses on the Conceptual NIST Reactor with a Split Core Using RELAP5-3D

Tao Liu, Zeyun Wu (Virginia Commonwealth Univ)

Fundamental Thermal Hydraulics: Experiments—IV

Session Organizers: Guanghui Su (Xi'an Jiao Tong Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Xiaodong Sun (Univ of Mich), Liangming Pan (CQU)
1750 **Investigation of Liquid Film Behavior in Upper Reactor Vessel Downcomer with Electrical Conductance Sensor Based on Flexible Printed Circuit Board**

*Chi-Jin Choi, Hyoung Kyu Cho (Seoul Natl Univ)*

1762 **That Dam Quality**

*Jeff Fluckiger, Daren Jensen (INL)*

1772 **Experiments on Helium-3 Negative Reactivity Insertion -HENRI- Prototype**

*G. Mignot, A. Warren, S. Balderrama, W. Marcum (OSU), N.Woolstenhulme (INL)*

1784 **Research Progress of Fission Gas Separation Technology Applied in Thorium Molten Salt Reactor**

*Junlian Yin, Tingting Zhang, Yalan Qian, Dezhong Wang (Shanghai Jiao Tong Univ)*

**Thermal Hydraulics in Advanced Reactors: General—IV**

*Session Organizers: Ferry Roelofs (NRG), Maria Avramova (NCSU)*

*Co-chairs: Maria Avramova (NCSU), Wei Li (CNPE)*

1794 **System Thermal-Hydraulics During SBO with a Passive Safety Feature of Hybrid SIT**

*Seok Cho, Byoung-Uhn Bae, Jae-Bong Lee, Yu-Sun Park, Jong-Rok Kim, Kyoung-Ho Kang (KAERI)*

1805 **BEPU of MSLB LOCA on a Generation III Reactor Based on RELAP5/SCDAP 3.4**

*Ye Yang, Jun Yang, Chengcheng Deng (Huazhong Univ), Mamaru Ishii (Purdue Univ)*

**Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—IV**
Results on Thermal Hydraulic Experiments in the LBE-Cooled Scaled Pool Facility E-SCAPE in Support of the Myrrha Design and Licensing

Katrien Van Tichelen, Fabio Mirelli (SCK-CEN)

LEBE-Cooled Scaled Pool Facility E-SCAPE: Results and Applications for Code Validation

D. Castelliti, K. Van Tichelen, F. Mirelli (SCK-CEN)

Validation of CFD Analyses Against Pool Experiments E-SCAPE

D. C. Visser, F. Roelofs (NRG), F. Mirelli, K. Van Tichelen (SCK-CEN)

Numerical Simulation of Loss-of-FlowTransient in the MYRRHA Reactor

L. Koloszar, Ph. Planquart (Karman Inst for Fluid Dynamics), K Van Tichelen, S. Keijers (SCK-CEN)

Boiling and Condensation Fundamentals—IV

A Preliminary Study On Biphilic Surface for Enhanced Pool Boiling Performance

Do Yeong Lim, In Cheol Bang (UNIST)
Modelling Path of the Heterogeneous Spontaneous Nucleation—A New Driven Mechanism of Power Transient CHF

Yikuan Yan, Emory Brown, Wade Marcum (OSU)

An Experimental Study of Steam Condensation with the Presence of Air Under Free Convection Condition

Jinhoon Kang, Byongjo Yun (Pusan National Univ), Sang-Gyu Lim, Jong Cheon (KHNP Central Research Inst)

Boiling Heat Transfer Enhancement with Extremely High Thermal Effusivity of Phase Change Material

Ji Yong Kim, In Cheol Bang (UNIST)

Severe Accidents: General—I

Session Organizer: Fulvio Mascari (ENEA)

Cochairs: Jinzhao Zhang (Tractebel Engineering S.A.), Guillaume Mignot (OSU)

EDF MAAP5.04 LOCA Transient Simulations Improvements

Jeremy Bittan (EdF)

Uncertainty Analysis of Severe Accident in the Spent Fuel Pool

V. Vileiniskis, A. Kaliatka, E. Ušpuras (Lithuanian Energy Inst), D. Merrouche (CRNB)

Uncertainty Analysis of Vessel Failure Mode and Melt Release in Station Blackout Scenario in Nordic BWR Using MELCOR Code

Sergey Galushin, Pavel Kudinov (KTH)

The Effect of Severe Accident Scenarios on In-Vessel Debris Relocation in Nordic BWRs

Sergey Galushin, Pavel Kudinov (KTH)
NPP Transient and Accident Analysis—I

Session Organizer: Dan LaBrier (ISU)

Cochairs: Jae Jun Jeong (PNU), Stephen Louria (OSU)

1971 Status of TRACE Model Development and Validation at NPP Gösgen in Switzerland

Davide Papini, Rainer Kaulbarsch, Jens-Uwe Klügel (Nuclear Power Plant Gösgen-Däniken AG), Evgeni Borisov, Kaliopa Mancheva (GCR Ltd)

1985 Applicability of the TRACE Model of NPP Gösgen to Safety Analyses of BDBA Sequences

Davide Papini, Rainer Kaulbarsch, Jens-Uwe Klügel (Nuclear Power Plant Gösgen-Däniken AG), Evgeni Borisov, Kaliopa Mancheva (GCR Ltd)

1998 Thermal-Hydraulic Calculations for Technical Condition and Lifetime Extension Assessment of SUNPP-3 Reactor

Oleksandr Mazurok, Oleksandr Mihaylenko (ESG), Volodymyr Kravchenko (Odessa National Polytechnic Univ)

2012 Determination of Representative Validation Scenarios for Emergency Operating Guidelines

Qingming Yang (China Nuclear Power Eng Co., Ltd.), Minfeng Chen (China Zhongyuan Eng Corp.), Jun Wang (China Nuclear Power Eng Co., Ltd)

Computational Fluid Dynamics V&V—I

Session Organizers: Lane Carasik (VCU), Barton Smith (USU)

Cochairs: Brian Jackson (Kairos Power), Aleksandr Obabko (ANL)
Validation of Numerical Particle Tracking Inside a HLM Reactor with Measurements in a Water Model

Ph. Planquart, C. Spaccapaniccia, S. Buckingham (von Karman Inst), K. Van Tichelen (SCK-CEN)

Validation of NEK5000 for 37- and 61-Pin Wire-Wrap Geometries with Conjugate Heat Transfer

Aleksandr Obabko, Elia Merzari (ANL), Landon Brockmeyer (Texas A&M), Paul Fischer (ANL/Univ of Illinois), Tanju Sofu (ANL), Brian Jackson, Michael Steer (TerraPower), Rodolfo Vaghetto, Yassin A. Hassan (Texas A&M)

CFD Verification and Validation of Wire-Wrapped Pin Assemblies

Mathieu Martin, Daniel Leonard, R. Brian Jackson, K. Michael Steer (TerraPower)

TUESDAY, AUGUST 20, 2019, 1:20 P.M.

Keynote Session—V

Session Organizer and Chair: Piyush Sabharwall (INL)

Toward Exascale: Large Eddy Simulation and Direct Numerical Simulation of Nuclear Reactor Flows with the Spectral Element Method

Elia Merzari (ANL), invited

Keynote Session—VI

Session Organizer and Chair: Jeff Luitjens (NuScale)
Separate-Effect Experiments and Modeling for Two-Phase Flow Under Geometric Restrictions

Seungjin Kim, Ran Kong (Purdue Univ), invited

Keynote Session—VII

Session Organizer and Chair: Ferry Roelofs (NRG)

Development of a Fast Reactor and Related Thermal Hydraulics Studies in Japan

Hiroyuki Ohshima, Hideki Kamide (JAEA), invited

Computational Multi-Fluid Dynamics—V

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Yang Liu (ANL), Ling Zou (ANL)

Overview of Mitigation Models Dedicated to Severe Accidents and Consequences on Flow Rate Through Containment Concrete Structures

Stephane Mimouni (EdF R&D), Paul Baconnier (ESPCI), Germain Day (EdF R&D)

Development and Multi-Level Validation of a Mechanistic Heat Flux Partitioning Model for Boiling Heat Transfer

Ravikishore Komajosyula, Etienne Demarly, Emilio Baglietto (MIT)

Numerical Simulation of Film Boiling on a Horizontal Surface in Oscillating System

Young Seock An, Byeongjae Jae Kim, Nam Kyu Ryu (Chungnam National Univ)

On Development and Validation of Subcooled Nucleate Boiling Models for OpenFOAM Foundation Release
J. Peltola, T. Päättikangas (VTT Technical Research Centre of Finland Ltd), W. Bainbridge (CFD Direct Ltd), R. Lehnigk, F. Schlegel (HZDR)

**Thermal Hydraulics of TREAT—I**

**Session Organizer: Colby Jensen (INL)**

**Cochairs: Colby Jensen (INL), Brad Heath (INL)**

2164 Design and CFD Modeling of the Gas Injection System for the Out-of-Pile HENRI Facility

S. Balderrama Prieto, G. Mignot, W. Marcum (OSU), N. Woolstenhulme (INL)

2177 Study of Transient CHF and Post-CHF Flow Boiling

Soon Kyu Lee (Univ of New Mexico), Nicholas R. Brown (Univ of Tennessee-Knoxville), Kurt A. Terrani (ORNL), Colby B. Jensen (INL), Heng Ban (Univ of Pittsburgh), Youho Lee (Seoul National Univ)

2183 A Systematic Approach to Inform Experiment Design Through Modern Modeling and Simulation Methods

A. Epiney, C. Rabiti, C. Davis (INL)

2197 Sensitivity Studies of Heater Rod Design for Transient Critical Heat Flux Experiments In TREAT

Richard O. Hernandez (Penn State), Charles P. Folsom, Nicolas E. Woolstenhulme, Colby B. Jensen (INL), Jacob P. Gorton, Nicholas R. Brown (Univ of Tennessee, Knoxville)

**Computational Fluid Dynamics—V**

**Session Organizer: Jinyong Feng (MIT)**
**Cochairs: Rui Hu (ANL), Yiqi Yu (ANL)**

2209 Comparison of Computational Fluid Dynamics and Subchannel Numerical Solutions of Fuel Assemblies Characterised by Bowing

R. Puragliesi, R. Mukin, I. Clifford, H. Ferroukhi (PSI), M. Seidl (PreussenElektra GmbH)

2223 Development of a Data-Driven Turbulence Model for 3D Thermal Stratification Simulation During Reactor Transients

Yangmo Zhu, Nam Dinh (NCSU), Rui Hu, Adam Kraus (ANL)

2235 Parametric Evaluation of Thermal Performance of Concentric Recuperator Heat Exchanger for Multifunctional Forced Convection PBLI LOOP DRAGON-V

Muhammad Salman Khan (CAS/Univ of Science and Technol of China), Qunying Huang, Yunqing Bai, Lei Wang, Zhiqiang Zhu (CAS)

**Computational Thermal Hydraulics: General—IV**

**Session Organizer: Mathieu Martin (TerraPower)**

**Cochairs: Dirk Lucas (HZDR), Dominique Bestion (CEA)**

2246 Development and Assessment of Adjoint Sensitivity Analysis Method for Transient Two-Phase Flow Simulations

G. Hu (ANL/Univ of Illinois), T. Kozlowski (Univ of Illinois)

2260 Comparison of the 3D Nodal Integral Method for Arbitrary Hexahedral Elements and Spectral Element Method

Ibrahim Jarrah, Rizwan- Uddin (Univ of Illinois)
Critical Flow Prediction by System Codes—Recent Analyses Made Within the FONESYS Network

M. Lanfredini (GRNSPG-UNIPI), D. Bestion (Consultant), F. D'Auria, N. Aksan (GRNSPG-UNIPI), P. Fillion (CEA), P. Gaillard (Framatome), J. Heo (KAERI), I. Karppinen (VTT), K. D. Kim (KAERI), J. Kurki, L. Lifang, A. Shen (SPICRI), J.-L. Vacher (EdF), D. Wang (CNL)

Simulation and Analysis of the Sodium-Cooled Fast Reactor Steam Generator

Zenan Che, Peng Du, Bo Zhang, Pan Wu, Li Ge, Jianqiang Shan, Junli Gou (Xi'an Jiaotong Univ)

Fundamental Thermal Hydraulics: Experiments—V

Session Organizers: Guanghui Su (Xi'an Jiao Tong Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Dillon Shaver (ANL), Yong Hoon Jeong (Kaist)

Experimental Study of the Surface Evaporation Rate of a Heated Water Pool Using Infrared Thermography

J. Martin, B. Migot (IRSN)

Quenching Experiment of Cr-Alloy Accident Tolerant Cladding Under Low and High Subcooling Conditions

Wang Kee In, Kwan-Geun Lee (KAERI)

Velocity- and Scalar-Field Measurements of Turbulent Buoyant Jets in a Two-Layer Stratified Environment

Sunming Qin, Victor Petrov, Annalisa Manera (Univ of Michigan)

Intelligent Identification System for Boiling Dynamics from Acoustic Emission Signal Using Machine Learning Technique

Seok Bin Seo, Do Yeong, Lim, In Cheol Bang (UNIST)
Thermal Hydraulics in Sodium-Cooled Fast Reactors: Severe Accident Analysis

Session Organizer: Brian Jackson (Kairos Power)

Cochairs: Dong-Wook Jerng (Chung-Ang Univ), Marine Anderhuber (CEA)

2350 Prospects for a CEA and ROSATOM/IPPE Collaborative Program on Na Boiling for GEN IV SFRs Safety: Rationale and Thermal-Hydraulic Preparatory Work


2364 Comparison of Margins of Sodium Bulk Boiling and Reactor Vessel Creep Under RVACS Operation by Micro-Integral Effect Test

Minho Lee, In Cheol Bang (UNIST), Dong-Wook Jerng (Chung-Ang Univ)

2377 Fragmentation Behavior and Heat Transfer During Molten Aluminum-Liquid Sodium Interaction

Liang Hu, Kui Ge, Yapei Zhang, G. H. Su, Wenxi Tian, Suizheng Qiu (Xi’an Jiaotong Univ)

Thermal Hydraulics in Lead-Cooled and Lead-Bismuth-Cooled Fast Reactors—V

Session Organizer: Ferry Roelofs (NRG)

Cochairs: Diego Castelliti (SCK), Adam Kraus (ANL)

2384 Calculation Tool for Heat Exchanger Tube Rupture in Pool-Type Reactors

D. Castelliti (SCK-CEN), G. Lomonaco (GeNERG – DIME/TEC)
2398 Experimental Campaign in Support of the Safety Studies of the STGR in LFR

Alessandro Del Nevo, Marcia Eboli (ENEA), Alessio Pesetti, Nicola Forgione (Univ of Pisa)

2411 Characterization of Leak Detection in HLM System Using LIFUS5/MOD3 Facility

Marica Eboli, Alessandro Del Nevo (ENEA), Nicola Forgione (Univ of Pisa), Fabio Giannetti (Sapienza Univ of Rome), Daniele Mazzi (SRS S.r.l.), Marco Ramacciotti (ISE S.r.l.),

2425 Numerical Analysis of the Axial Lead-Bismuth Pump Performance Based on the Different Rotation Speed

Kailin Wang, Liangxing Li, Wei Xie, Shuangbao Zhang (Xi’an Jiaotong Univ)

Boiling and Condensation Fundamentals—V

Session Organizer: Byongjo Yun (PNU)

Cochairs: Ki Yong Choi (KAERI), Tomio Okawa (The Univ of Electro-Communications)

2439 Infrared Study of Flow Boiling and CHF on Prototypical Surfaces with Nuclear Fuel Cladding Morphology

Guan-Yu Su, Chi Wang, Jee Hyun Seong, Artyom Kossolapov, Bren Phillips, Matteo Bucci (MIT)

2447 Enhancement of Condensation Heat Transfer by Hydrophobic and Nano Porous Surface

Taeseok Kim, Yun Sik Cho, Sung Joong Kim (Hanyang Univ), Jaemin Lee, Wonjoon Choi (Korea Univ)

2461 Dependence of Nanoscale Roughness on Wicking-Based CHF Enhancement for Fresh and Oxidized Cr-Coated Surfaces

Namgook Kim, Hong Hyun Son, Sung Joong Kim (Hanyang Univ)
2470 Direct Contact Condensation Induced Transition from Oscillatory Bubble to Stratified Flow

Dingding Liang, Lu Tao, (Beijing Univ of Chemical Technol)

Severe Accidents: General—II

Session Organizer: Etienne Studer (CEA)

Chair: Peter Pandazis (GRS)

2483 Simplified Thermohydraulic Criteria for a Comparison of the Accidental Behaviour of Gen-IV Nuclear Reactors and of PWRS

F. Bertrand, N. Marie, A. Bachrata, J. B. Droiin, X. Manchon (CEA)

2497 Analyses with MELCOR Code of an Unmitigated SBO Scenario with In Vessel Retention Strategy Applied to a Generic PWR 900 MWe

F. Mascari, S. Ederli (ENEA)

2511 Pressurized Environments and Effect of Silica Gel Amount on Depressurization Inside the Containment

Dong Hoon Kam, Yong Hoon Jeong (KAIST)

2519 Development of Risk Oriented Accident Analysis Methodology (ROAAM+) for Assessment of Ex-Vessel Severe Accident Management Effectiveness

P. Kudinov, S. Galushin, D. Grishchenko (KTH), S. Yakush (IPMech RAS)

NPP Transient and Accident Analysis—II

Session Organizer: Dan LaBrier (ISU)
Chair: Dan LaBrier (ISU)

2536 Screening Analysis for Pressurized Thermal Shock (PTS) Transient Scenarios


2550 RELAP5-3D Simulation of Complex Flow Patterns Both In-Core and Inside the Reactor Upper Plenum to Assess the Performance of Reactor Coolant Temperature Sensors Located at the Core Outlet and In-Core Elevation

Alex Matev (BEL V)

2564 Thermal Analysis for the Spent Fuel Pool Integrated with the Reactor Cavity of the Chinshan Plant Using GOTHIC

Yen-Shu Chen, Li-Ying Huang, Lin Ansheng, Yng-Ruey Yuann (INER)

Experiments and Data Bases for Assessment and Validation—I

Session Organizer: Richard Schultz (ISU)

Cochairs: Hyo Young Kyu Cho (Seoul Natl Univ), Victor Petrov (Univ of Mich)

2577 Experimental Study of an Adiabatic Two-Phase Flow in a Simulated PWR Spent Fuel Bundle

G. Brillant, J. Martin, B. Fourrè (IRSN)

2587Containment Spray Experiments in MISTRA Facility for Heat and Mass Transfer Model Validation in Superheated Atmosphere

2601 Experimental Investigations on the Heat Transfer Characteristics of Supercritical CO2 in a Single Circular Tube with Direct Electrical Heating

Konstantinos Theologou, Rainer Mertz, Jörg Starflinger (Univ of Stuttgart)

2615 Experimental Investigation of Heat Transfer Characteristics in Tubes to Cool CO2 Near the Critical Point in Horizontal Flow Orientation

Andreas Wahl, Rainer Mertz, Jörg Starfliner (Univ of Stuttgart)

Computational Fluid Dynamics V&V—II

Session Organizers: Lane Carasik (VCU), Barton Smith (USU)

Cochairs: Mike Acton (MIT), Yang Liu (Virg Tech U)

2629 Validation of CFD Application Scheme on the Critical Heat Flux Phenomena in Rod Bundle Channel with Spacer Grids

Xiaomeng Dong, Zhijian Zhang, Zhaofei Tian, Guangliang Chen (Harbin Eng Univ)

2640 CFD Modeling and Sensitivity Analysis of Ex-Vessel Core Melt Process

Pavel Zacha, Vaclav Zenezny (CTU in Prague, FME)

2652 RANS Simulations of Turbulent Round Jets in the Presence of Density Difference and Comparison with High-Resolution Experimental Data

Jiaxin Mao, Sunming Qin, Victor Petrov, Annalisa Manera (Univ of Michigan)

2666 Development and Validation of a Conjugate Heat Transfer Model for the Two-Phase CFD Code NEK-2P

Prasad Vegendla, Adrian Tentner, Dillon Shaver, Aleks Obabko, Elia Merzari (ANL)

TUESDAY, AUGUST 20, 2019, 4:20 P.M.
Technical Sessions - 4:20 P.M.

Computational Multi-Fluid Dynamics—VI

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Robert Brewster (Westinghouse), Yoshiteru Komuro (MHI)

2686 Analysis of Wall Nucleation Modeling for Flow Boiling in Fluent
Longcong Wang, Caleb S. Brooks (Univ of Illinois)

2699 Development of Thermal Hydraulic Simulation Method for Two-Phase Flow in Steam Generators
Yoshiteru Komuro, Atsushi Kodama, Ling Cheng, Yoshiyuki Kondo, Seinosuke Azuma, Hideyuki Morita, Koichi Tanimoto, Ryoichi Kawakami, Toshifumi Nariai (MHI), Yoshito Nishikawa (The Kansai Electric Power Co., Inc.), Takashi Hibiki (Purdue Univ)

2713 A Subcooled Boiling Model Developed for Narrow Rectangular Channels Based on the CFD Method
Linfeng Li, Mingjun Wang, Dalin Zhang, Wenxi Tian, G. ` S. Su, Suizheng Qiu (Xi’an Jiaotong Univ)

Thermal Hydraulics of TREAT—II

Session Organizer: Colby Jensen (INL)

Cochairs: Aaron Epiney (INL), Colby Jensen (INL)

2726 Experimental Design for Transient in-Pile Boiling Studies at the TREAT Facility
Colby Jensen, Nicolas Woolstenhulme, Charles Folsom, David Kamerman, Austin Fleming, Daniel Wachs (INL)

2738 Thermal Design of the TREAT Facility

Bradley Heath, Colby Jensen (INL)

2750 Visual Inspection to Monitor / Detect Boiling

Colby B. Jensen (INL), Kevin Terrill, Alberto Cardenas, Richard Christensen (Univ of Idaho)

2762 Comparison of Integration Methods of STAR-CCM+ and RELAP5-3D for Application to Sodium Based on TREAT Experiments

Cole Blakely (INL)

Computational Fluid Dynamics—VI

Session Organizer: Jinyong Feng (MIT)

Cochairs: Junsoo Yoo (INL), Jun Wang (Univ of Wisconsin, Madison)

2772 Optimization of Heat Transfer Rate Around Cylindrical PCM Containers in Energy Storage Coupled with Nuclear Power Plant

Ahmed K. Alkaabi, Yacine Addad, Saeed A. Alameri (Khalifa Univ)

2781 A Parametric CFD Boiling Study Using State-of-the-Art Two-Phase and Boiling Closure Models

Junsoo Yoo (INL), Emilio Baglietto (MIT)

2795 Accuracy Analysis of Near Wall Thermal Hydraulics Modeling of Molten Salt Reactors

M. Tano, Pablo Rubiolo (Univ of Grenoble-Alpes), Jean Ragusa (Texas A&M)
Fundamental Thermal-Hydraulics: Experiments—VI

Session Organizers: Guanghui Su (Xi'an Jiao Tong Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Wang Kee In (KAERI), Jongwoong Yoon (Kaist)

2809 An Advanced Ultrasonic Waveguide Concept for Spatially Distributed Monitoring of In-Core Temperatures


2818 Experimental Investigation on the Double-Hole Steam Jets Condensation Characteristics

Yuhao Zhang, Yonglong Yuan, (NCEPU), Lifang Liu, Xiaoliang Fu (SPIC/National Energy Key Laboratory of Nuclear Power Software), Li Feng (NCEPU), Zhongyi Wang (SPIC/National Energy Key Laboratory of Nuclear Power Software), Daogang Lu (NCEPU)

2826 Experimental Study on Single-Phase Flow Resistance Characteristics of Rectangular Channels with Lateral Non-Uniform Heating

Rulei Sun, D. L. Zhang, Jiancheng Zhou, Gongle Song, Wenxi Tian, Suizheng Qiu, G. H. Su (Xi’an Jiaotong Univ)

Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—I

Session Organizer: Brian Jackson (Kairos Power)

Cochairs: Mathieu Martin (TerraPower), Xiaoxue Huang (Univ of Sheffield)
Development of a Serpentine Tube Type Steam Generator with an Intermediate Heat Transfer Fluid for Prevention of SWR

Hyungmo Kim, Jung Yoon, Jaehyuk Eoh (KAERI), Namhyeong Kim, Moo-Hwan Kim (POSTECH), Dong Eok Kim (CAU)

Natural Convection of a Droplet-Laden Flow in a Cylindrical Enclosure Above a Hot Sodium Pool

Xiaoxue Huang, Shuisheng He (Univ of Sheffield)

Experimental and Numerical Investigation for Geometrical Effect on the Flow Characteristics for Plate-Throttle Entry Tube of Fast Reactor Fuel Assembly

Haiqi Qin, Daogang Lu, Cong Wang, Dawen Zhong, Yu Wang, Siyu Lyu (NCEPU)

**Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—I**

**Session Organizers:** Izabela Gutowska (OSU), Piyush Sabharwall (INL), Maria Avramova (NCSU)

**Cochairs:** Xiaodong Sun (UofM), Kyle Brumback (Kairos Power)

Design of a Direct Reactor Auxiliary Cooling System (DRACS) Considering Tritium Management for Advanced High-Temperature Reactor (AHTR)

Sheng Zhang, Hsun-Chia Lin, Keyong Cheng, Xiaodong Sun (Univ of Michigan)

Advancing Radiative Heat Transfer Modeling in High-Temperature Liquid-Salts

C. Coyle, E. Baglietto, C. Forsberg (MIT)

Assessment on the Practicality of Off-the-Shelf Valves for Use in Molten Salt

T. K. Howard, David Holcomb, Kevin Robb (ORNL)

**Severe Accidents: General—III**
**Session Organizer:** Fulvio Mascari (ENEA)

**Cochairs:** Jiri Duspiva (UJV), Etienne Studer (CEA)

2918 **Assessment of Severe Accident Management by Multiple Mitigation Actions Using Monte Carlo Sampling**

Wonjin Choi, Nam Kyung Kim, Joongoo Jeon, Sung Joong Kim (Hanyang Univ)

2930 **Effect of Water Radiolysis on the Heat Pipe Under Gamma Ray Irradiation for Fukushima Daiichi Decommissioning Use**

Yao Zhang, Takayuki Saimu, Shunichi Suzuki, Koji Okamoto (Univ of Tokyo)

**NPP Transient and Accident Analysis—III**

**Session Organizer:** Dan LaBrier (ISU)

**Chair:** Brian Woods (OSU)

2943 **PMSYS: Plant Management System as a Part of Swiss Simulation Platform**

K. Nikitin, I. Clifford, H. Ferroukhi (PSI)

2955 **Risk-Informed Safety Analysis for Accident Tolerant Fuels**


2969 **Transient Analysis of a Detailed Thermal-Hydraulic Model of a VVER-1000 Core with the System Code ATHLET**

Y. Périn, R. Henry, K. Velkov (GRS), S. P. Nikonov (Mephy)
Experiments and Data Bases for Assessment and Validation—II

Session Organizer: Richard Schultz (ISU)

Cochairs: Jeong Ik Lee (KAIST), Annalisa Manera (Univ of Mich)

2980 CATHARE 3D Modeling Capability of a Small-Scale Pool Test Rig Experiments

A. Bousbia Salah (Bel V), J. Martin (IRSN)

2992 Investigation of Drag and Virtual Mass Coefficients for Rising Ellipsoidal Bubbles

Alexander Dueñas, Isaiah Wieland, Wade Marcum, Qiao Wu (OSU)

3005 Methodology for Experimental Identification of Mixing Characteristics in the Primary System of PWR


Computational Fluid Dynamics V&V—III

Session Organizers: Lane Carasik (VCU), Barton Smith (USU)

Cochairs: Hyoung Kyu Cho (Seoul Natl Univ), Lane Carasik (VCU)

3014 Assessment, Implementation, Validation, and Verification of Interfacial Closures in Multiphase Flows for the CFD Codes FLUENT and CFX

Gustavo Montoya, Jay Sanyal (ANSYS, Inc.), Markus Braun (ANSYS Germany GmbH)
3030 The Evaluation of AP1000® Plant Cold Leg Thermal Stratification During PRHR HX Natural Circulation Test

Hong Xu, Natalie M. Rodgers Richard F. Wright, John W. Boufford, (Westinghouse)

3042 Validation of Condensation Models for Hydrogen Distribution Evaluation Using CFD

Noriaki Hamada, Masataka Hidaka (Hitachi, Ltd.), Tadashi Fujii, Takeshi Yamada (Hitachi-GE, Ltd)

Verification and Validation: General—IV

Session Organizer: Kim Kungdoo (KAERI)

Cochairs: Richard Schultz (ISU), Alessandro Petruzzi (NINE)

3054 Development of a Systematic Approach for Quantification of Thermal-Hydraulic Code Model Input Uncertainty

Jean Baccou (IRSN), Jinzhao Zhang (Tractebel Engineering S.A.), Philippe Fillion, 27645 Guillaume Damblin (CEA), Alessandro Petruzzi (NINE), Rafael Mendizábal (CSN), Francese Reventos (UPC), Tomasz Skorek (GRS), Mathieu Couplet, Bertrand Looss (EdF R&D), Deong-Yeon Oh (KINS), Takeshi Takeda (Nuclear Regulation Authority), Nils Sandberg (OECD NEA)

3068 Nuscale Safety Analysis Code and Design Validation Test Program

Matt Kizerian, Bradyn Wuth, Cristhian Galvez Velit, Maggie Wang, Robert Houser (NuScale Power)

WEDNESDAY, AUGUST 21, 2019, 7:20 A.M.

Keynote Session—VIII

Session Organizer and Chair: Jinyong Feng (MIT)
**Keynote Session—IX**

*Session Organizer and Chair: Bao-Wen Yang (Xi’an Jiaotong Univ)*

**Keynote Session—X**

*Session Organizer and Chair: Brian Woods (OSU)*

**Keynote Session—XI**

*Session Organizer and Chair: Wade Marcum (OSU)*
Computational Multi-Fluid Dynamics—VII

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Nadish Saini (NCSU), Yangmo Zhu (NCSU)

3140 Nucleate Boiling Simulation Using Interface Tracking Method
Mengnan Li, Igor Bolotnov (NCSU)

Kai Wang, Nejdet Erkan, Koji Okamoto (Univ of Tokyo)

3168 Numerical Study on the Dynamics of Bubble in Divergence of Venturi Tube
Yuchen Song, Junlian Yin, Dezhong Wang, Kangbei Cai (Shanghai Jiao Tong Univ)

3182 Improving the Understanding of Subgrid-Scale Deposition for Implementation in M-CFD Applications
G. Agostinelli, E. Baglietto (MIT)

Computational Fluid Dynamics—VII

Session Organizer: Jinyong Feng (MIT)

Cochairs: Bin Han (XITU), Jinyong Feng (MIT)
A CFD Study on the Hydrodynamics for Tandem Plate Configurations Under Turbulent Flow

Wade Marcum, Jonathan Gjemso (OSU)

CFD Analysis of the Fluid Flow, Heat Transfer and Cladding Oxidation in a PWR Fuel Bundle

Dong-Yuan Sheng (Westinghouse Electric Sweden AB/KTH), Marcus Seidl (PreussenElektra GmbH), Zhouqi Du (Technical Univ Munich)

Framatome’s Unified Single-Phase CFD Methodology for Fuel Design and Analysis

A.Hatman, S. Lydzinski, L. Charlot, G. Bache (Framatome), B. Farges (Framatome SAS), J. Dumond, M. Rehm, K. Vogel (Framatome GmbH)

Thermal Analysis for eVinci™ Micro Reactor

Hong Xu, Jurie J. Van Wyk, Richard F. Wright (Westinghouse)

Computational Thermal Hydraulics: General—V

Session Organizer: Mathieu Martin (TerraPower)

Cochairs: Bin Han (XJTU), Rui Hu (ANL)

Numerical Simulation of Penetration Flow into T-Junction Branch Lines

Y. Utanohara, K. Miyoshi, M. Kamaya (Inst of Nuclear Safety System, Inc.)

Statistical Emulator Models for Scalar Mixing in Reactor Safety Analysis

A. Gairola (Kansas State Univ), W. Guo, B. Niceno (PSI), H. Bindra (Kansas State Univ)

Universal Digital Nuclear Reactor System (UNDREAS)
Chirayu Batra, Vladimir Kriventsev (IAEA)

3280 Numerical Investigation of the Transient Flow with Alternating Diagonal Flow Direction in Wall Bounded Inline Tube Bundles

Weikai Gao, Xiaowei Li, Xinxin Wu (Tsinghua Univ)

Natural Circulation, Passive Safety Systems and Related Phenomena—I

Session Organizer: Yuquan Li (State Power Investment Central Research Inst)

Cochairs: Jun Yang (HUST), Mark Lanza (PNNL)

3292 Transient Local Thermal Hydraulics Data for Two-Phase Flow Instability in Natural Circulation

Taiyang Zhang, Zhiie Jhia Ooi, Caleb S. Brooks (Univ of Illinois)

3302 Natural Circulation of Sodium, Lead, LBE, Helium and Molten Salt Cartridge Closed Loops

S. A. Balderrama Prieto (OSU), P. Sabharwall (INL), M. Farmer (ANL)

3315 Propagation of Stratified Density Fronts in the HiRJet Facility

Daniel Nunez, Victor Petrov, Annalisa Manera (Univ of Michigan)

Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—II

Session Organizer: Brian Jackson (Kairos Power)

Cochairs: Saya Lee (TAMU), Mathieu Martin (TerraPower)
Development of a Polyhedral Staggered Mesh Scheme Application to Subchannel and CFD SFR Thermal Hydraulics

Antoine Gerschenfeld, Yannick Gorsse, Gauthier Fauchet (CEA)

Visualization of Flow Inside Reactor Vessel Using 1/5-Down Scaled Model of Prototype Gen-IV Sodium Cooled Fast Reactor

Woo Shik Kim, Yong Seok Choi, Dong-Jin Euh (KAERI)

Study on Multi-Dimensional Core Cooling Behavior of Sodium Cooled Fast Reactors Under DRACS Operating Condition

T. Ezure, T. Onojima, M. Tanaka, J. Kobayashi, A. Kurihara (JAEA), Y. Kameyama (NDD Cooperation)

Experimental Study on Heat Dissipation of Spent Fuel Assembly of Sodium Fast Reactor During Defueling

Zenghui Wu, Jinbiao Xiong, Xiang Chen (Shanghai Jiao Tong Univ)

Thermal Hydraulics in Supercritical Water Reactors

Session Organizer: Xu Cheng (KIT)

Cochairs: Jinbiao Xiong (Shanghai Jiao Tong Univ), S. Z. Qiu (Xi’an Jiao Tong Univ)

Heat Transfer Deterioration and Enhancement in the Thermal Entry Length of Laminar Supercritical Water Channel Flow

R. Barney (LLNL/Univ of California, Berkeley), R. Nourgaliev (LLNL), J. P. Delplanque (Univ of California, Davis), R. McCallen (LLNL)

The Preliminary Safety Analysis of a s-CO₂ Brayton Cycle Cooled Reactor System

Chuntian Gao, Pan Wu, Jianqiang Shan (Xi’an Jiao Tong Univ)
A Study in the Effect of External Vertical Acceleration on the Uniformly Heated Channel with Supercritical Water

Jin-Der Lee, Shao-Wen Chen (Natl Tsing Hua Univ)

Experimental Measurement Techniques and Flow Visualization—I

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Jean-Marie Le Corre (Westinghouse in Sweden), Jun Wang (Univ of Wisconsin, Madison)


Jee Hyun Seong (MIT), Min Seop Song, Eung Soo Kim (Seoul Natl Univ), Daniel Nunez, Annalisa Manera (Univ of Michigan)

Accelerating Infrared Boiling Heat Transfer Studies with Online Machine Learning Capabilities

M. Ravichandran, M. Bucci (MIT)

Experimental Investigation of Bubble Nucleation, Growth and Departure Using Synchronized IR Thermometry, Two-Color LIF and PIV

Gustavo M. Aguiar (MIT), Victor Volgaropoulos, Omar K. Matar, Christos N. Markides (Imperial College London), Matteo Bucci (MIT)

Severe Accidents: General—IV

Session Organizer: Fulvio Mascari (ENEA)

Cochairs: Terttaliisa Lind (PSI), Guillaume Mignot (OSU)
Scaling Analysis on the Coolability of Fuel Rods and Debris Beds with Seawater
Zayed Ahmed, Hitesh Bindra, Steven Eckels (Kansas State Univ)

How Much Was Hydrogen Gas Burned in the 1F3 Explosion
Wison Luangdilok (Fauske & Associates, LLC)

Modeling and Experiments of Severe Accidents—I

Session Organizer: Guillaume Mignot (OSU)

Void Fraction Distribution in a Header-Feeder Test Facility Under a Simulated Loss-of-Coolant Accident
Étienne M. Lessard, Jun Yang (CNL)

An Analytical Model of Plume/Droplet Interactions for the Assessment of Spent-Fuel-Pool Spray Cooling Effectiveness
J. Martin (IRSN), N. Tsukamoto (NSA)

Experimental and Numerical Research on Melting Behavior Mechanism of Fuel Rod Using MPS-CV Method
Wenxi Tian, Yonglin Li, Tangtao Feng, Ronghua Chen, Suizheng Qiu, G. H. Su (Xi’an Jiao Tong Univ)

Experimental Investigation of Debris Bed Relocation Behavior by Bottom Gas-Injection
Chunming Teng, Bin Zhang, Jianqiang Shan (Xi’an Jiaotong Univ)
Experiments and Data Bases for Assessment and Validation—III

Session Organizer: Richard Schultz (ISU)

Chair: Victor Petrov (Univ of Mich)

3530 Numerical and Experimental Investigation of the Water Flow Through PWR Spacer Grids at the Brazilian Nuclear Technology Development Center


3542 Validation of Risk-Informed Safety Margin Characterization for Flooding of Nuclear Power Plants

M. André, P. Bardet (George Washington Univ), R. Sampath, N. Montanari (Centroid Lab), L. Lin (NCSU), S. Prescott, E. Ryan (INL)

3554 High-Resolution High-Speed Void Fraction Measurements in Helical Tubes Using X-Ray Radiography

David Breitenmoser (Univ of Michigan/ETHZ), Annalisa Manera (Univ of Michigan), Horst Prasser (ETHZ), Victor Petrov (Univ of Michigan)

Computational Fluid Dynamics V&V—IV

Session Organizers: Lane Carasik (VCU), Barton Smith (USU)

Cochairs: Han Young Yoon (KAERI), Trevor Howard (ORNL)

3568 CFD Validation of Buoyancy Driven Jet Spreading, Mixing and Wall Interaction
Graham Macpherson (Frazer-Nash Consultancy), Ryan Tunstall (Rolls-Royce)

3582 Uncertainty Quantification and Reduction for Multiphase-CFD Solvers: A Data-Driven Bayesian Approach Supported by High-Resolution Local Measurements

Yang Liu, Xiaodong Sun (Univ of Michigan), Yang Liu (Virginia Tech), Nam Dinh (NCSU)

3598 Verification and Validation of COMSOL for Heat Transfer in Thin Rectangular Channels Using NACA Test Results

T. K. Howard, P. Jain, E. Popov (ORNL)

**Thermal Hydraulics of Space Applications**

*Session Organizer: Lane Carasik (VCU)*

*Cochairs: Lane Carasik (VCU), Robert Martin (BWXT)*

3612 Modeling Gamma and Neutron Heating to a Liquid Hydrogen Tank for Nuclear Thermal Propulsion with RELAP5-3D

R. P. Martin (BWX Technol), J. A. Caffrey, M. G. Houts (NASA)

3624 Evaluation of a Desuperheating Spray Chamber for a Scaled Nuclear Thermal Propulsion Rocket Exhaust Capture System Test

R. P. Martin, J. L. Gustafson (BWXT), D. J. Coote (NASA)

3637 Numerical Investigations on the Turbulent Prandtl Number Models for Internal Forced Convection to Low-Pr Helium-Xenon Mixtures

Biao Zhou, Jun Sun, Yuliang Sun, Yu Ji (Tsinghua Univ)

**WEDNESDAY, AUGUST 21, 2019, 10:20 A.M.**
Computational Multi-Fluid Dynamics—VIII

Session Organizer: Igor A. Bolotnov (NCSU)

Cochairs: Seung Jun Kim (LANL), Matthew Zimmer (NCSU)

3649 Progress Toward Simulating Departure from Nucleate Boiling (DNB) at High Pressure Applications with Selected Wall Boiling Closures

Seung Jun Kim, Mario R. Naranjo, Russell C. Johns (LANL), Emilio Baglietto (MIT)

3663 Exploring Two-Phase Flow Regime Transition Mechanisms Using High Resolution Virtual Experiments

Matthew D. Zimmer, Igor A. Bolotnov (NCSU)

3677 Simulations of Particle Transport Inside Bubbles Using Coupled Interface and Lagrangian Tracking Approaches

Min Zhu (Nanjing Univ of Science and Technology), A. Dehbi Y. Sato, B. Niceno (PSI)

3689 Numerical Simulation Investigation on Two-Phase Flow Instabilities in Two-Parallel-Channel

Jianping Long (Xi’an Jiaotong Univ), Baowen Yang (Xi’an Jiaotong Univ/Delta Energy Group), Sipeng Wang (Xi’an Jiaotong Univ)

Subchannel Fluid Dynamics and Heat Transfer—I

Session Organizer: Philippe Fillion (CEA)

Cochairs: Marco Lanfredini (UNIPI), Antoine Gerschenfeld (CEA)
Application of the COBRAG Subchannel Code to Fuel Design

S. Oh, B. Hizoum, K. Kang, D. Miranda, J. Andersen, S. Bowman (GE Hitachi Nuclear Energy)

Transient Subchannel Analysis of BWR Fuel Thermal Hydraulic Performance

B. Hizoum, D. Miranda, K. Kang, S. Oh, J. Andersen, S. Bowman (GE Hitachi Nuclear Energy)

Experimental Thermal-Hydraulic Study of a Steam-Droplets Flow Inside a Vertical Pipe—Application to LOCA in PWR Reactor

J. D. Peña Carrillo, A. V. S. Oliveira, T. Glantz (IRSN), M. Gradeck, Al. Labergue, (Univ of Lorraine)

Computational Fluid Dynamics—VIII

Session Organizer: Jinyong Feng (MIT)

Cochairs: Subash Sharma (Purdue Univ), Yixiang Liao (HZDR)

Hybrid Nodal Integral -Finite Element Method (NI-FEM) for 2D, Time-Dependent Burgers’ Equation in Arbitrary Geometries

Sundar Namala, Rizwan-Uddin (Univ of Illinois)

Application of Computational Fluid Dynamics (CFD) Codes For Nuclear Power Plant Design

M. Krause (IAEA), B. Smith (Goldsmith Transactions), T. Hoehne (HZDR), W. K. In (KAERI)

Density Wave Instability Verification of CFD Two-Fluid Model

S. L. Sharma, M. A. Lopez de Bertodano (Purdue Univ), J. R. Buchanan (NNL)

Computational Thermal Hydraulics: General—VI
3779 Remaining Issues in System Thermal Hydraulics How the Fonesys and CONUSAF Networks Can Help Find Solutions?

D. Bestion (Consultant), F. d’Auria (Univ di PISA), Y. Hassan (Texas A&M), N. Aksan (Scientific Consultant), M. Lanfredini (Univ di PISA), K. D. Kim (KAERI)

3792 A New Approach of Studying Transient Critical Heat Flux Using Computational Fluid Dynamics

T. Chen, Wade Marcum (OSU)

3806 A New Hypothesis of Transient Boiling Based on the CFD Simulation and Past Experimental Studies

T. Chen, W. Marcum (OSU)

3820 SPH Simulation on Single Bubble Behavior in Linear Shear Flow

Yelyn Ahn, Young Beom Jo, So Hyun Park, Jin Woo Kim, Eung Soo Kim (Seoul Natl Univ)

Natural Circulation, Passive Safety Systems and Related Phenomena—II

3833 Improved Design of Spent Fuel Dry Storage Using Phase Change Heat Transfer of Hybrid Control Rod-Heat Pipe
Kyung Mo Kim, In Cheol Bang (UNIST)

3844 Experimental Investigation on Atmospheric, Passive Spent Fuel Pool Cooling by Two-Phase Closed Thermosyphons

Claudia Grass, Rudi Kulenovic, Jöerg Starflinger (Univ of Stuttgart)

3856 Buoyancy-Driven Transformations in a Thermal Striping Flow Field

S. Lomperski, A. Obabko E. Merzari, (ANL)

Thermal Hydraulics in Sodium-Cooled Fast Reactors: Steady Analysis—III

Session Organizer: Brian Jackson (Kairos Power)

Cochairs: Dan LaBrier (ISU), Thomas Fanning (ANL)

3865 Thermal Hydraulic Design of an In-Pile Experimental Loop for Fast Test Reactor Conditions

Anton Higgins, Dan LaBrier, Wade Marcum, Ben Lilley, Todd Palmer (OSU)

3879 Computational Fluid Dynamics Assessment of Proposed Axial Reflector Designs for the Versatile Test Reactor Using Nek5000

D. R. Shaver, H. Yuan, F. Heidet (ANL)

3893 Integrated Simulation Capabilities for Thermal Hydraulic Analysis of Test Vehicles in the Versatile Test Reactor


Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—II

Session Organizers: Izabela Gutowska (OSU), Piyush Sabharwall (INL), Maria Avramova (NCSU)
Cochairs: Caleb Brooks (Univ of Illinois), Glenn Roth (Information Systems Lab)

3908 Transient Analysis of an FHR Coupled to a Helium Brayton Power Cycle
Guolei Zhang (Harbin Eng Univ), Minghui Chen, Xiaodong Sun (Univ of Michigan)

3922 Molten Salt Coolant Modeling In TRACE
Glenn Roth, Jay Spore (Information Systems Laboratories)

3931 CFD Simulation of Xenon Removal by Helium Bubble Sparging in Molten Salt
Jiaqi Chen, Caleb S. Brooks (Univ of Illinois)

3945 Flow Rates in a Natural Circulation FLiBe Loop
Karl Britsch, Mark Anderson, Kumar Sridharan (Univ of Wisconsin, Madison)

Experimental Measurement Techniques and Flow Visualization—II

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Xiaodong Sun (U of Michigan), Junlian Yin (Shanghai Jiao Tong U, SJTU)

3955 Uncertainty Analysis of PIV Measurements for Liquid Velocity in Two-Phase Bubbly Flows
Yang Liu, Yalan Qian, Chengqi Wang, Xiaodong Sun (Univ of Michigan), Yang Liu (Virginia Tech)
Characterization of Liquid Jet Breakup for the Simulation of Accidental Sodium Leakage Scenarios in Sodium-Cooled Fast Reactors

Mira Sadek, Thierry Gilardi (CEA), Rudy Bazile (IMFT), Stéphane Mimouni, Lynda Porcheron (EdF R&D)

Important Issues in Validation of Computational Fluid Dynamics Codes Against CFD Grade Experimental Results

C. W. Hollingshead, A. Rashkovan (NRCN), A. Maunsell, M. Hodgins, D. R. Novog (McMaster Univ)

Preliminary Results on the Development of a Fast-Neutron Tomography System for Void Fraction Distribution Measurements

G. G. Patterson, D. R. Novog (McMaster Univ)

Fuel Coolant Interaction, Modeling and Experiments—I

Session Organizer: Etienne Studer (CEA)

Cochairs: Jeremy Bittan (EDF), Fulvio Mascari (ENEA)

Ex-Vessel Fuel Coolant Interaction Experiment with the Geometry of an AP1000 Reactor

Giancarlo Albrecht, Leonhard Meyer (KIT), Rongjin Zhang (SPICRI)

Premixed Layer Formation Modelling in Stratified Melt-Coolant Geometry

Janez Kokalj, (Jozef Stefan Inst/Univerza v Ljubljani), Matjaž Leskovar, Mitja Uršič (Jozef Stefan Inst)

Risk of Containment Failure Due to Ex-Vessel Steam Explosion for Nordic BWRs

Dmitry Grishchenko, Sergey Galushin, Pavel Kudinov (KTH)

Melt Droplet Fragmentation Behavior During Fuel-Coolant Interaction
Modeling and Experiments of Severe Accidents—II

Session Organizer: Fulvio Mascari (ENEA)

Cochairs: Marco Pellegrini (IAE), Jiri Duspiva (UJV)

4050 Dispersion of Surrogate LWR Fuel Experiments Under LOCA Conditions

G. D. Latimer, W. R. Marcum (OSU), W. F. Jones (INL)

4063 A Summary of Fission-Product Transport Phenomena During SGTR Severe Accidents

T. Lind (PSI), S. Campbell (NRC), L. E. Herranz (CIEMAT), M. Kissane (OECD/NEA), JinHo Song (KAERI)

4076 Simulation of In-Vessel Retention Scenarios in PWR with ATHLET-CD

P. Pandazis, S. Weber (GRS)

Experiments and Data Bases for Assessment and Validation—IV

Session Organizer: Richard Schultz (ISU)

Cochairs: Byong Jo Yun (PNU), Cesar Frepoli (FPoliSolutions LLC)

4087 Managing a Station Blackout (SBO) at the INKA Test Facility with Nothing but Passive Technology
Thomas Wagner, Thomas Mull (Framatome GmbH)

4098 Digitization and Management of Thermal Hydraulic Legacy Data Using FPoliDON Platform

Cesare Frepoli (FPoliSolutions LLC)

Plant System Code Analysis and Development—I

Session Organizer: Mathieu Martin (TerraPower)

Cochairs: Han Bao (NCSU), Dominique Bestion (CEA)

4109 Revisiting the PIRT and Scaling Analysis Within the Frame of 3D System Code Modelling

D. Bestion (Consultant), P. Fillion (CEA)

4123 Application of Adjoint Based Node Optimization Method to Nuclear Thermal-Hydraulic System Analysis Code

Jae Jun Lee, Seongmin Son, Min-Gil Kim, Jeong Ik Lee (KAIST)

4137 Preliminary Tasks to Integrate CATHARE_2 3D Reactor Vessel Module in Real-Time Simulators at EDF/DT

David Pialla, Marc Ludmann, Karine Vareille (EdF)

4150 A Rotodynamic Pump Seizure Transient Simulated Using the CATHARE-3 One-Dimensional Pump Model

L. Matteo, G. Mauger (CEA), P. Gyomlai (Framatome), A. Dazin (LMFL), N. Tauveron (CEA)

WEDNESDAY, AUGUST 21, 2019, 1:20 P.M.
Keynote Session—XII

Session Organizer and Chair: Guillaume Mignot (OSU)

4164 Multiscale and Multiphysics Simulation of Sodium Fast Reactors: From Model Development to Safety Demonstration

Antoine Gerschenfeld (CEA), invited

Keynote Session—XIII

Session Organizer and Chair: Brian Woods (Oregon State University)

4178 Molecular Tagging Velocimetry: Pushing the Limits of Velocimetry

P. M. Bardet, C. Fort, M. A. Andre (George Washington Univ), invited

WEDNESDAY, AUGUST 21, 2019, 2:20 P.M.

Technical Sessions - 2:20 P.M.

Thermal Hydraulics in Small Modular Reactors and Micro Reactors—I

Session Organizer: Milorad Dzodzo (Westinghouse)

Cochairs: Brian Wolf (NuScale Power), Milorad Dzodzo (Westinghouse)

4184 Overview of Thermal-Hydraulic Validation Tests with SMART-ITL to Support SMART Pre-Project Engineering
Comparison of Two Different Sized Small Break LOCAs on the Passive Safety Injection Line with SMART-ITL

Jin Hwa Yang, Hwang Bae, Sung-Uk Ryu, Byong-Guk Jeon, Sung-Jae Yi, Hyun-Sik Park (KAERI)

Hot Spot Temperature Prediction for a Micro Modular High Temperature Gas-Cooled Reactor

Sung Nam Lee, Nam-il Tak, Chang Keun Jo (KAERI)

Development of a SCDAP/RELAP5 Model for the Simulation of the Helical-Coiled Once-Through Steam Generators

Ziyi Xu, Maolong Liu, Yao Xiao, Hanyang Gu (Shanghai Jiao Tong Univ)

Subchannel Fluid Dynamics and Heat Transfer—II

Session Organizer: Philippe Fillion (CEA)

Cochairs: Guillaume Bois (CEA), David Pialla (EDF)

Flow Dynamic Behavior in Rod Bundles: An Experimental Assessment

O. C. A. Nalin, P. Lazo (CNEA), C. P. Marcel (CONICET), invited

Effect of Part-Length Rods and Transient Flow for Different BWR Subchannel Geometries

Lukas Robers, Horst-Michael Prasser (ETH Zürich)

Unsteady Pressure and Velocity Measurements in 5x5 Rods Bundle Using Grids with and Without Mixing Vanes

N. Turankok, F. Bazin, V. Biscay, T. Lohez, F. Moreno, S. Testanière, Lionel Rossi (CEA)
4273 Experimental Investigation of Power Transient Critical Heat Flux for Downward Flow in Narrow Rectangular Channel Used in Research Reactor

Hui Yung Kim, Jae Jun Jeong, Byong Jo Yun (Pusan National Univ)

Core Thermal Hydraulics and Subchannel Analysis—I

Session Organizer: David Aumiller (BAPL)

Cochairs: David Aumiller (BMPC), Aiguo Liu (Xi’an Jiaotong Univ)

4287 A Three-Dimensional PWR LBLOCA Simulation Using the CUPID Code

Ik Kyu Park, Han Young Yoon, Seung Jun Lee, Yun Je Cho, Jae Ryong Lee (KAERI)

4299 Advanced Modelling Capabilities for Pin-Level Subchannel Analysis of PWR and VVER Reactors

Manuel Garcia, Uwe Imke, Diego Ferraro, Victor Sanchez-Espinoza, Luigi Mercatali (KIT)

4310 Chimney and Diverging Effects in Core PWR: Analysis and Experimental Characterization for Predictive Behaviour During Loss of Coolant Accident

Christophe Rabe, Raphaël Préa (CEA)

Hydrogen and Fission Product Behavior

Session Organizer: Etienne Studer (CEA)

Cochairs: Sung Joong Kim (Hanyang Univ), Davide Papini (Nuclear Power Plant Gösgen-Däniken AG)
CFD Analysis of Hydrogen Flame Acceleration with Burning Velocity Models

K. Motegi, N. Trianti, T. Matsumoto, T. Sugiyama, Y. Maruyama (JAEA)

Numerical Investigation of the Effect of Buoyancy Forces on the Deflagration of Hydrogen in the THAI Facility

A. Attavino, L. Koloszar, P. Planquart (Von Karman Inst), M. Adorni (BelV), A. Parente (Université libre de Bruxelles)

Development of a Radionuclide Release Module for an Integrated Source Term Analysis Tool for Liquid Metal Cooled Fast Reactors

T. Q. Hua (ANL), S. J. Lee (Fauske & Associates, LLC), J. Liao (Westinghouse), A. Moisseytsev (ANL), P. Ferroni (Westinghouse), A. Karahan (ANL), C. Y. Paik (Fauske & Associates, LLC), A. M. Tentner, T. Sofu (ANL)

Numerical Study of Lean Limit Hydrogen Flames Propagating Upward to Validate a Flammability Limit Model

Joongoo Jeon, Hoichul Jung, Yeon Soo Kim, Sung Joong Kim (Hanyang Univ)

Natural Circulation, Passive Safety Systems and Related Phenomena—III

Session Organizer: Yuquan Li (State Power Investment Central Research Inst)

Chair: Mark Lanza (PNNL)

Preliminary RELAP5 System Analysis of the Water-Based NSTF—Part 1: Model Development

Q. Lv, A. Kraus, R.Hu, M. Bucknor, D. Lisowski (ANL)

Preliminary RELAP5 System Analysis of the Water-Based NSTF—Part 2: Parametric Study

Q. Lv, A. Kraus, R.Hu, M. Bucknor, D. Lisowski (ANL)
4406 Turbulent Natural Convective Condensation on the Underside of Inclined Surfaces for the AP1000® Plant Containment

Matthew M. Swartz, John Lojek, Richard F. Wright, Ryan T. Vanston (Westinghouse)

**Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—I**

**Session Organizer:** Antoine Gerschenfeld (CEA)

**Cochairs:** Antoine Gerschcenfeld (CEA), Adam Kraus (ANL)

4418 Onset of Natural Convection in a Sodium-Cooled Fast Reactor During a Station Black-Out: Blind Benchmark of Safety Assessment Using Multi-Scale Coupled Thermal Hydraulics Codes

Simon Li, Antoine Gerschendfeld (CEA), Olivier Bernard, Thomas Sageaux (Framatome)

4430 Modelling of the DIADEMO Experiment with the CATHARE Code for ASTRID Gas Power Conversion System Studies

G. Mauger, M. Hochart, B. Grosjean, P. Taraud, B. Morassano (CEA)

4443 Oscillation Phenomenon Study for the Anti-Siphon Equipment in CFR600 Design

Yan Peng (China Inst of Atomic Energy)

**Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—III**

**Session Organizers:** Izabela Gutowska (OSU), Piyush Sabharwall (INL), Maria Avramova (NCSU)

**Cochairs:** Rui Hu (ANL), Lambert Fick (Kairos Power)
Validating System Analysis Module (SAM) Models Using Natural Circulation Experimental Data

Hsun-Chia Lin (Univ of Michigan), Rui Hu (ANL), Xiaodong Sun (Univ of Michigan)

Modelling the Draining of a Molten Chloride Salt Reactor

Emily Lewis, Gregory Cartland-Glover, Stefano Rolfo, Charles Moulinec, David R. Emerson (STFC), Bruno Merk (Univ of Liverpool)

Progress in the Thermal Hydraulic Modeling of the Molten Salt Fast Reactor

M. Tano, P. Rubiolo (Univ of Grenoble-Alpes), J. Ragusa (Texas A&M)

Experimental Measurement Techniques and Flow Visualization—III

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Shuichiro Miwa (Hokkaido U), Jun Liao (Westinghouse)

Measurements of Boiling Heat Transfer, Time-Averaged Void Fraction Distributions Using Neutron Radiography

Abir Muhammad, Boris Khaykovich, Jan Petrik, Artyom Kossolapov, Bren Phillips, Matteo Bucci (MIT)

Automatic Detection of Bubble Footprints and Dry Spots in Infrared Boiling Heat Transfer Investigations Using Deep Convolution Neural Networks

Muhammad Abir (MIT), Shaikat M. Galib (Missouri Univ Sci Technol), Jee Hyun Seong, Matteo Bucci (MIT)

Ultrasound Measurement of Upward Liquid Film Flow in Vertical Pipe

Yuki Wada, Akira Satou, Yasuteru Sibamoto, Taisuke Yonomoto (JAEA), Jun Sagawa (Mito Electronic Solution)
High-Fidelity Velocity Measurements in a Totally Blocked Subchannel of a Wire-Wrapped 61-PIN Hexagonal Fuel Bundle


Fuel Coolant Interaction, Modeling and Experiments—II

Session Organizer: Guillaume Mignot (OSU)

Chair: Yu Maruyama (JAEA)

New Film Boiling Correlations for Drops and Fragments in Fuel Coolant Interaction Codes

E. De Malmazet (EdF)

Effects of Salinity in Coolant on Steam Explosion

Qiang Guo, Louis Manickam, Weimin Ma, Sevostian Bechta (KTH)

Validation of a Full Model for the Analysis of Ex-Vessel Steam Explosion in LWRs

Dmitry Grishchenko, Pavel Kudinov (KTH)

Plant System Code Validation—I

Session Organizer: Kent Welter (NuScale)

Cochairs: Hengliang Shen (NuScale Power), Xu Wu (NCSU)

Predictability of System Codes for Void Fraction in Bundle
Yunseok Lee, Yeongjae Lee, Taewan Kim (Incheon National Univ)

4587 Benchmark Simulation of the Natural Convection Shutdown Heat Removal Test Facility Using SAM

B. Hollrah, R. Hu, M. Bucknor, D. Lisowski (ANL), Y. Hassan, R. Vaghetto (Texas A&M)

4601 Validation of S3K Against the Olkiluoto 2 Pump Trip Event May 8th 2018

Christian Jönsson, Gerardo Grandi (Studsvik Scandpower), Aarno Isotalo, Ville Hynönen (Teollisuuden Voima Oyj)

4615 Validation and Uncertainty Quantification for Two-Phase Natural Circulation Flows Using TRACE Code

K. Borowiec, T. Kozlowski, C. S. Brooks (Univ of Illinois)

**Plant System Code Analysis and Development—II**

**Session Organizer: Mathieu Martin (TerraPower)**

**Cochairs: Ivor Clifford (PSI), Francis Buschman (Bettis Atomic Power Laboratory)**

4624 First Assessments of the Dynamic Gap Conductance Model in TRACE

I. Clifford, C. Cozzo, H. Ferroukhi (PSI)

4637 The New Critical Discharge Model for ATHLET

T. Skorek (GRS)

4650 An Enhanced Property File for RELAP5-3D

J. Luitjens, K. Schmidt, B. Wolf (NuScale Power)

4665 Development of a Thermal-Hydraulic Analysis Code for Helically Coiled Once Through Steam Generator

Jun Huang, Junli Gou, Jianqiang Shan (Xi’an Jiaotong Univ)
Technical Sessions - 4:20 P.M.

Multiscale Multiphysics Applications in Thermal Hydraulics—I

Session Organizer: Bao-Wen Yang (XJTU)

Cochairs: Michael Z. Podowski (RPI), Bin Han (XJTU)

4681 A Three-Dimensional Multi-Physics Analysis of the Steam Line Break Accident of a PWR Using CUPID-RV/MASTER

Jae Ryong Lee, Ik Kyu Park, Seung Jun Lee, Yun Je Cho, Yong Hee Choi, Han Young Yoon (KAERI)

4690 Applicability of Gothic 8.3(QA) for Non-LWR Simulation, Aerosol Modeling and Hydrogen Management

J. W. Lane, T. L. George, S. W. Claybrook, J. A. Zankowski (Zachry Nuclear Eng, Inc.), T. Kindred (EPRI)

Subchannel Fluid Dynamics and Heat Transfer—III

Session Organizer: Philippe Fillion (CEA)

Cochairs: Matteo Bucci (MIT), Philippe Fillion (CEA)

4704 Critical Heat Flux Model for Vertical Annular Mist Flow Conditions in a Rod Bundle
José N. Reyes, Jr. (NuScale Power)

4720 A Criterion to Classify Void Fraction Profiles in Adiabatic Bubbly Flows Based on Averaged Flow Quantities for Use in Subchannel Codes

Ravikishore Kommajosyula (MIT), Guillaume Bois, Alan Burlot, Maria Giovanna Rodio, Benjamin Cariteau (CEA), Emilio Baglietto (MIT)

4732 Mapping Coherent Thermal Structures in a Rod Bundle

S. Lomperski, J. Licht (ANL)

Core Thermal Hydraulics and Subchannel Analysis—II

Session Organizer: David Aumiller (BAPL)

Cochairs: Bao-Wen Yang (XJTU), Jean-Marie Le Corre (Westinghouse)

4741 Investigations of Neutron Noise Induced by Transient Cross Flow in a PWR Reactor Core

Zhuoqi Du (Technical Univ Munich), Dong-Yuan Sheng (Westinghouse Electric Sweden AB), Marcus Seidl (PreussenElektra GmbH), Rafael Macián-Juan (Technical Univ Munich)

4755 On the Use of Small-Scale LES for Full-Length Heated Fuel Rod Simulations

Javier Martinez, Elia Merzari (ANL)

4769 Subchannel Analysis of Mixed Convection in a Rod Bundle

Ting Wu, Baowen Yang (Xi’an Jiaotong Univ)

Accuracy and Uncertainty Analysis—I

Session Organizer: Jinbiao Xiong (SJTU)
Cochairs: Shanbin Shi (RPI), Jinbiao Xiong (SJTU)

4780 Addressing the Usage of CFD Within the CSAU Framework for Nuclear Reactor Safety Analysis Simulations

Michael Acton, Emilio Baglietto (MIT)

4795 Inverse Uncertainty Quantification by Hierarchical Bayesian Inference for TRACE Physical Model Parameters Based on BFBT Benchmark

Chen Wang (Univ of Illinois), Xu Wu (MIT), Tomasz Kozlowski (Univ of Illinois)

4808 A Study on Coupling Calculation Convergence Criterion Based on Uncertainty Analysis

Xiaolie Wang, Jianjun Wang, Zhiqiang Zhu (Harbin Eng Univ)

Fundamental Thermal Hydraulics: General—I

Session Organizer: Caleb Brooks (Univ of Illinois)

Cochairs: Shuichiro Miwa (Hokkaido U), Caleb Brooks (Univ of Illinois)

4817 About Phenomena Identification in a PIRT

D. Bestion (Consultant)

4831 Analytical Solution to a One-Dimentional Two-Region Heat Conduction Problem with Time Dependent Heat Input

Yikuan Yan, Emory Brown, Wade Marcum (OSU)
Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—II

Session Organizer: Antoine Gerschenfeld (CEA)

Cochairs: Clotaire Geffray (CEA), Rizwan-Uddin (Univ of Illinois)

4841 Transient Analyses of the Versatile Test Reactor Using RELAP5-3D
C. Parisi, C. Davis, G. Youinou (INL)

Sundar Namala, Rizwan-Uddin (Univ of Illinois), Tyler Sumner (ANL)

4864 Validation of the MATHYS Tool for the Design of Sodium-Cooled Fast Reactors Using PHENIX End-of-Life Test Data
Clotaire Geffray, Antoine Gerschenfeld, Yannick Gorsse (CEA)

Thermal Hydraulics in Salt-Cooled High-Temperature Reactors—IV

Session Organizers: Izabela Gutowska (OSU), Piyush Sabharwall (INL), Maria Avramova (NCSU)

Cochairs: Mark Anderson (U of Wisc), Haihau Zhao (Kairos Power)

4876 Molten Salt to Supercritical CO₂ Diffusion-Bonded Heat Exchanger Testing to Support Component Certification for Advanced Nuclear Power Systems
Shaun R. Aakre, Mark H. Anderson (Univ of Wisconsin, Madison)
Triple Flow Heat Exchanger with Intermediate Oval Twisted Tube for FHRs

Amir Ali, Bryan Wallace, Edward D. Blandford (Univ of New Mexico)

3D Coupled Transient Simulation of a Fast Liquid Fuel Molten Salt Reactor Primary Loop Using GeN-Foam

Muhammad Altahhan, Sandesh Bhaskar, Paolo Balestra, Jason Hou, Maria Avramova (NCSU), Nicholas Smith (Southern Co.), Carlo Fiorina (EPFL)

Experimental Measurement Techniques and Flow Visualization—IV

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Selim Kuran (NuScale), Yang Liu (U of Michigan)

Application of Strain Gages in a Highly Advective Environment for Measurement of Fluid-Structure Interactions


An Approach to Instrumenting a Full-Scale 61-Pin Hexagonal Fuel Bundle for Flow-Induced Vibration Testing


Fuel Coolant Interaction, Modeling and Experiments—III

Session Organizer: Sung Joong Kim (Hanyang Univ)

Chair: Alessandro Del Nevo (ENEA)
Investigation on the Characteristics of Melt Jet Breakup in Water with Both Experiment and LBM Methods

Hui Cheng, Jiyun Zhao (City Univ of Hong Kong)

Fuel-Coolant Interaction Modeling Supporting TREAT Experimental Analysis

R. Armstrong (Univ of Wisconsin/INL), H. Jo, M. L. Corradini (Univ of Wisconsin, Madison)

Experimental Study on the Molten Materials Effect in Fuel-Coolant Interaction

Pengfei Liu, Longkun He, Bo Kuang (Shanghai Jiao Tong Univ)

Parametric Studies on CHF Trends for a Downward Facing Curved Geometry Under a Flow Condition

Jun Yeong Jung, Dong Hoom Kam, Yong Hoon Jeong (KAIST), Hae Min Park (KAERI)

Modeling and Experiments of Severe Accidents—III

Session Organizer: Guillaume Mignot (Oregon State University)

Chair: Didier Jacquemain (IRSN)

Developing Separate Effects Transient Test Experiments Using an Out-of-Pile Flowing Water Loop

Daniel P. LaBrier, Yikuan Yan, Emory Brown, Wade R. Marcum (OSU)

Study on Fuel Damage Progression and Porosity in the SFD 1-4 Test

5006 Heat Transfer Model at Interface Between Molten Core and Concrete for Anisotropic Ablation

Kyoung M. Kang (Univ of Wisconsin, Madison/GE Hitachi Nuclear), Michael L. Corradini (Univ of Wisconsin, Madison), Mitchell T. Farmer (ANL)

5020 Inter-System Loss of Coolant Accident (ISLOCA) of APR1400 with Severe Accident Condition

Byeonghee Lee, Kwang Soon Ha (KAERI)

Plant System Code Validation—II

Session Organizer: Kent Welter (NuScale)

Cochairs: Pravin Sawant (NuScale Power), Olu Omotowa (TerraPower)

5029 H2020 MYRTE Circe-Hero Experimental Campaign: Post-Test Activity and Code Validation

D. Castelliti, T. Hamidouche (SCK-CEN), P. Lorusso (Univ of Roma), M.Tarantino (ENEA)

5043 MARS-KS Code Assessment on LOCA Test in Pressurized Water Loop Facility of PHWR


5052 Data Assimilation with Subchannel Analysis Code CTF on NUPEC BWR BFBT Test Matrix

Atsushi Ui, Yoshiro Kudo, Masahiro Furuya (CRIEPI)

5064 Horizontal Stratification and Its Application to PWR LOCA Analysis

Jun Liao (Westinghouse)

Fluid-Structure Interactions—I
Session Organizer: Afaque Shams (NRG)

Cochairs: Afaque Shams (NRG), Angel Papukchiev (GRS)

5078 Numerical Study of Flow-Induced Vibration of Nuclear Fuel Rods

D. De Santis, A. Shams (NRG)

5092 Numerical Simulations of the Turbulence-Induced Vibrations of a Wire-Wrapped Hexagonal Fuel Assembly

H. Dolfen, J. De Ridder (Ghent Univ), L. Brockmeyer, E. Merzari (ANL), G. Kennedy, K. Van Tichelen (Belgian Nuclear Research Centre), J. Degroote (Ghent Univ)

5103 Elastic Vibration Characteristics of Strips in Turbulent Water Flow

Botao Zhang, Yechen Zhu, Shengjie Gong, Hanyang Gu, Zhenqin Xiong (Shanghai Jiao Tong Univ)

THURSDAY, AUGUST 22, 2019, 7:20 A.M.

Keynote Session—XIV

Session Organizer and Chair: Azat Galimov (NuScale)

5116 Smaller and Safer: How Micro-Reactors Can Redefine Nuclear

Ken Canavan, Yasir Arafat, Ryan Blinn (Westinghouse), invited

Keynote Session—XV

Session Organizer and Chair: Fulvio Mascari (ENEA)
5126 Challenges in Containment Thermal Hydraulics


THURSDAY, AUGUST 22, 2019, 8:20 A.M.

Technical Sessions - 8:20 A.M.

Multiscale Multiphysics Applications in Thermal Hydraulics—II

Session Organizer: Bao-Wen Yang (XJTU)

Cochairs: Michael Z. Podowski (RPI), Davide Papini (Nuclear Power Plant Gösgen-Däniken AG)

5141 Fuel Assembly Bow Evaluations with Computed Hydraulic Forces
Robert A. Brewster, Yuriy Aleshin (Westinghouse)

5151 Development, Verification and Validation of the Multi-Scale CATHARE—NEPTUNE CFD Coupling
Clotaire Geffray (CEA), Chaï Koren (EdF R&D)

5165 Multi-Scale Coupling of TRACE and TrioCFD Based on ICoCo
K. L. Zhang (KIT), X. L. Zhang (KIT/USTC), V. H. Sanchez Espinoza, R. Stieglitz (KIT)

5179 Analyses of the Flow Mixing Phenomena in a Pressurized Water Reactor by 1d- and Coupled 1d-3d Simulations
H. V. Hristov, J. Herb, A. Papukchiev (GRS)
Two-Phase Flow and Heat Transfer Fundamentals—I

Session Organizer: Dillon Shaver (ANL)

Chair: Jeff Luitjens (NuScale)

5193 Film Thickness and Disturbance Wave Structure of Upward Annular Flow
Guanyi Wang, Ke Tang, Mamoru Ishii (Purdue Univ)

5204 Investigation of the Mechanisms Which Govern Bubble Geometry in the Spherical Cap Regime Through the Application of Particle Image Velocimetry
Isaiah Wieland, Alexander Dueñas, Wade Marcum, Qiao Wu (OSU)

5218 Experimental Study of Flooding Phenomenon in Vertical Annular Smooth and Corrugated Channels
A. Biton (NRCN/Ben-Gurion Univ of the Negev), E. Rabinovich, R. Freud (NRCN), E. Gilad (Ben-Gurion Univ of the Negev)

5230 Prediction of Annular Two-Phase Flow with Heat Transfer
Wenyuan Fan, Haipeng Li, Henryk Anglart (KTH)

Accuracy and Uncertainty Analysis—II

Session Organizer: Jinbiao Xiong (SJTU)

Cochairs: Yixiang Liao (HZDR), Maolong Liu (SJTU)
K. Borowiec, C. Pigg, T. Kozlowski (Univ of Illinois)

Uncertainty and Sensitivity Analysis of the PBF SFD Test 1-4 Using MAAP5 Code
Ikuo Kinoshita (Inst of Nuclear Safety System, Inc)

Sensitivity Analysis on the Critical Mass Flowrate Based on Sobol’ Indices Through Replicated LHS
Lucia Sargentini, Guillaume Damblin (CEA)

A Best-Estimate-Plus-Uncertainty-Based Method for Design and Design Verification
R. P. Martin (BWX Technol)

Fundamental Thermal Hydraulics: General—I

Session Organizer: Caleb Brooks (Univ of Illinois)

Cochairs: Xu Wu (MIT), Juliana Duarte (Virginia Tech)

Otto Linsuain, Boyan D. Ivanov (Westinghouse)

A Correlation of the Water Film Thickness and Friction Factor for Supercritical/Subcritical Transition in a Hot-Leg Pipe Geometry
S. Al Issa, R. Macian-Juan (Technical Univ Munich)

Thermal Hydraulics in Sodium-Cooled Fast Reactors: Transient Analysis—I

Session Organizer: Antoine Gerschenfeld (CEA)
Cochairs: Hitesh Bindra (KSU), Simon Li (CEA)

5315 Application of Unstructured Mesh-Based Sodium-Water Reaction Analysis Code SERAPHIM

Akihiro Uchibori, Takashi Takata (JAEA), Yoshimi Shiina, Akira Watanabe (NDD Corp.)

5325 Experimental Measurement of Liquid Metal Flow Fields in a Scaled SFR Upper Plenum

Brendan Ward, Broderick Sieh, Hitesh Bindra (Kansas State Univ)

5334 Development of LMFBR System Analysis Code NUSOL-LMR and Analysis of the Transient Accidents in CEFR

Peng Du, Jianqiang Shan, Bo Zhang (Xi’an Jiaotong Univ)

Thermal Hydraulics in Small Modular Reactors and Micro Reactors—II

Session Organizer: Milorad Dzodzo (Westinghouse)

Cochairs: Milorad Dzodzo (Westinghouse), Seth Cadell (OSU)

5342 Coupled Neutronics/Thermal Hydraulics Assessment of Graphite Moderated Molten Salt Reactors

A. Nalbandyan, E. B. Klinkby, B. Lauritzen (DTU Nutech), J. Groth Jensen, R. Steyn (Seaborg Technologies)

5356 Experimental Study on the Steam Generator Performance of SMART-ITL Facility

Hwang Bae, Sung-Uk Ryu, Jin-Hwa Yang, Byong Guk Jeon, Yoon Gon Bang, Sung-Jae Yi, Hyun-Sik Park (KAERI)
5367 Development of a Parametric Computational Fluid Dynamics Model to Estimate Passive Aerosol Decontamination


5385 Characterization of Containment Heat Transfer In NuScale Power Small Modular Reactor (SMR)

Pravin Sawant, Selim Kuran (NuScale Power LLC)

Experimental Measurement Techniques and Flow Visualization—V

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Jun Liao (Westinghouse), David Arcilesi (U of Idaho)

5399 Detailed Measurements of Void-Fraction Distribution in an Adiabatic Fuel Bundle Performed with High Resolution Gamm-Ray Tomography Imaging

Julio Diaz, Robert Adams, Victor Petrov, Annalisa Manera (Univ of Michigan)

5413 Flow Structure in Dead-Ended, Coolant Loop Reactor Branch Lines Related to Thermal Fatigue Onset

J. R. Downing, V. Petrov, A. Manera (Univ of Michigan), invited

5424 Modal Analysis of Parallel Rectangular Jets Interactions in the RCCS Separate-Effects Test Facility

Daniel Nunez, Benedikt Krohn, Victor Petrov, Annalisa Manera (Univ of Michigan)

5438 Statistical Characterization of Gas-Liquid Flow in Swirl Vane Separator with Image Processing Technique

Li Liu (Jiao Tong Univ/Ji’an Jiaotong Univ), Bofeng Bai (Xi’an Jiaotong Univ)
Natural Convection and Mixing Phenomena, Modeling and Experiments—I

Session Organizer: Guillaume Mignot (OSU)

Cochairs: Jeremy Bittan (EDF), Lucas Albright (Univ of Utah)

5449 CFD Prediction of Natural Convection During External Reactor Vessel Cooling
Marco Colombo, Michael Fairweather (Univ of Leeds)

5463 CFD Analysis of the CIGMA Experiments on the Heated Jet Injection into Containment Vessel with External Surface Cooling
A. Hamdani, S. Abe, M. Ishigaki, Y. Sibamoto, T. Yonomoto (JAEA)

5480 Analysis of Dynamic Natural Convection™ Cooling Combined with FLEX Mitigation During Station Blackout Events
Stephen M. Hess, Tom Elicson, Matthew Griffiths (JENSEN HUGHES), Brian Beley, Michael Torcaso, Greg Lazarro (NuVision Eng), Aladar Csontos (EPRI)

5491 Analysis of Dynamic Natural Convection™ Cooling Combined with Accident Tolerant Fuel and FLEX Mitigation During Station Blackout Events
Stephen M. Hess, Tom Elicson, Matthew Griffiths (JENSEN HUGHES), Brian Beley, Michael Torcaso, Greg Lazarro (NuVision Eng), Aladar Csontos (EPRI)

Modeling and Experiments of Severe Accidents—IV

Session Organizer: Yu Maruyama (JAEA)

Cochairs: Fulvio Mascari (ENEA), Lucas Albright (University of Utah)
A Two Phase Mathematical Model to Describe the Dissolution of Corium Crust by Molten Steel

Shambhavi Nandan, Florian Fichot, Fabien Duval (IRSN)

Experimental Studies on Two-Layer Corium Heat Transfer in Light Water Reactor Lower Head in LIVE2D Facility

X. Gaus-Liu, Th. Cron, B. Fluhrer (KIT)

Computational Fluid Dynamics for In-Vessel Retention: Challenges and Achievements

A. Shams, D. Dovizio, K. Zwijsen (NRG), C. Le Guennic (EDF R&D), L. Saas, R. Le Tellier, M. Peybernes, B. Bigot (CEA), E. Skrzypek, M. Skrzypek (NCBJ), L. Vyskocil (UJV Rez a. s.), L. Carenini, F. Fichot (IRSN)

MAAP5 Benchmarking to the TRACE Thermal Hydraulic Tool

Hu Luo, Matthew Griffiths (JENSEN HUGHES), Thomas Kindred, Richard Wachowiak (EPRI)

MAAP5-VVER Validation and IAEA-SPE-3 Modeling

Tom Elicson, Hugh Luo (JENSEN HUGHES), Lajos Tarczal (Paks Nuclear Power Plant), Tom Kindred, Rick Wachowiak (EPRI)

Plant System Code Validation—III

Session Organizer: Kent Welter (NuScale)

Cochairs: Jaejun Jeong (Pusan Natl Univ), Pawel Domitr (National Atomic Energy Agency PAA)

The Assessment of the Critical Flow Models of MELCOR2.2 and TRACE V5.0 Against MARVKEN Critical Flow Tests

Pawel Domitr (National Atomic Energy Agency), Piotr Darnowski (Warsaw Univ of Technol), Michal Spirzewski (National Centre for Nuclear Research)
Test Result and MARS-KS Calculation with Uncertainty Propagation Analysis for Pressurizer Surgeline IBLOCA

Byoung-Uhn Bae, Jae-Bong Lee, Yu-Sun Park, Jong-Rok Kim, Seok Cho, Kyoung-Ho Kang (KAERI)

Development and Assessment of the Thermal Hydraulic System Code ARSAC-K for Analysis of PWR LB LOCA

Mingjun Zhong, Dan Wu, Shuhua Ding, Wei Chen, Yaou Shen, Xiaowei Jiang, Jian Deng (NPIC)

Fluid-Structure Interactions—II

Session Organizer: Afaque Shams (NRG)

Cochairs: Wade Marcum (OSU), Elia Merzari (PSU)

Review Paper on Water Film Characteristics

M. Moustafa, T. Ruifeng (Harbin Eng Univ)

Assesment of High Performance Computing for Nuclear Reactor Thermal Hydraulics Applications

Adam Padee, Tomasz Kwiatkowski, Piotr Wasiuk, Tobiasz Jarosiewicz, Sławomir Potempsk (National Centre for Nuclear Research), Afaque Shams (NRG)

Dynamics of a Solitary Wire-Wrapped Pin in Axial Flow: A Theoretical Model

C. A. Nixon, W. R. Marcum (OSU)

THURSDAY, AUGUST 22, 2019, 10:20 A.M.

Multiscale Multiphysics Applications in Thermal Hydraulics—III
Coupled APROS-CFD Simulation of Generic VVER-440 Loss of Feedwater Transient

T. Rämä, T. Toppila, J. Kättö (Fortum Power and Heat), V. Hovi, T. Pättikangas (VTT Technical Research Centre of Finland Ltd)

Thermal-Hydraulic Simulation of Advanced Gas-Cooled Reactors Steam Generators Using Coupled Porous CFD and 1D Two-Phase Flow Modelling


Preliminary Application of the GeN-Foam Multiphysics Tool to the Analysis of the FFTF Sodium Fast Reactor: Coupling Thermal Hydraulics and Core Deformations

Carlo Fiorina, Stefan Radman (EPFL), Andreas Pautz (PSI)

Two-Phase Flow and Heat Transfer Fundamentals—II

Investigation of Subcooled Flow Boiling and CHF on Unoxidized and Oxidized Zircaloy-4 Surfaces

Jee Hyun Seong, Chi Wang, Bren Phillips, Matteo Bucci (MIT)
5701 **X-Ray Radiography for Two-Phase Mixture Level Fluctuation During Boil-Off in Rod Bundle for Wide Pressure Range**

*T. Arai, M. Furuya, H. Takiguchi, Y. Nishi, K. Shirakawa (CRIEPI)*

5709 **Unexpected Heat Transfer Oscillations in Steady Annular Flow Detected by Synchronized Infrared and Liquid Film Sensor Measurements**

*G.-Y. Su, B. Phillips, J. Buongiorno (MIT), F. P. D’Aleo, R. M. Streich, H. M. Prasser (ETH Zurich), E. Al-Safran (Kuwait Univ)*

**Core Thermal Hydraulics and Subchannel Analysis—III**

**Session Organizer: David Aumiller (BAPL)**

**Cochairs: Hisashi Ninokata (Politecnico di Milano), Sipeng Wang (Xi’an Jiaotong Univ)**

5716 **CFD and Experiments for Wire-Wrapped Fuel Assemblies**

*F. Roelofs, H. Uitslag-Doolaard, B. Mikuz, D. Dovizio, D. De Santis, A. Shams (NRG), F. Bertocchi, M. Rohde (TU Delft), KI. Van Tichelen, S. Keijers, G. Kennedy (SCK-CEN), A. Batta, J. Pacio (KIT), P. Planquart (VKI), A. Obabko (ANL), L. Brockmeyer (ANL/TAMU), Elia Merzari (ANL), R. Vaghetto, Y. Hassan (TAMU), D. Leonard, M. Martin, B. Jackson, M. Steer (Terrapower), M. Delchini, D. Pointer (ORNL)*

5730 **A Review of CFD Approaches for Turbulent Mixing Model Development in Subchannel Code**

*Aiguo Liu, Bao-Wen Yang (Delta Energy Group/Xi’an Jiaotong Univ), Xianlin Zhu (Xi’an Jiaotong Univ)*

5752 **A Review of Grid Induced Diversion Cross Flow Models in Subchannel Code and the Development**

*Aiguo Liu (Delta Energy Group), Bao-Wen Yang, (Delta Energy Group/Xi’an Jiaotong Univ), Xianlin Zhu (Xi’an Jiaotong Univ)*
5763 A Bundle CHF Mechanism Model and Its Preliminary Verification Under PWR Conditions

Yang Liu, Jianqiang Shan, Bo Zhang (Xi’an Jiaotong Univ), Wei Liu (NPIC)

Accuracy and Uncertainty Analysis—III

Session Organizer: Jinbiao Xiong (SJTU)

Cochairs: Guanyu Su (MIT), Han Bao (NCSU)

5776 Sensitivity Analysis of Minor Leaks in Light Water Reactor Environments

Lukasz Sokolowski (Kiwa Inspecta Nuclear AB)

5790 Uncertainty Quantification of Thermal-Hydraulic CFD Simulation Using Hybrid Monte-Carlo and Polynomial-Chaos-Expansion Method

D. Gitelman (NRCN/Technion), M. Katz (NRCN), A. N. Shocron, I. Tsarfis, S. Frankel (Technion)

Fundamental Thermal Hydraulics: General—III

Session Organizer: Caleb Brooks (Univ of Illinois)

Cochairs: Juliana Duarte (Virginia Tech), Xu Wu (MIT)

5804 Experiment and Numerical Simulation of a Single Bubble Formation Under a Downward Face of Different Contact Angles

Kai Wang, Nejdet Erkan, Koji Okamoto (Univ of Tokyo)
Bayesian Calibration of Empirical Models Common in MELCOR and Other Nuclear Safety Codes

N. W. Porter, V. A. Mousseau (SNL)

Overview of Nuclear Reactor Thermal Hydraulic R&D in Xi’an Jiaotong University

G. H. Su, Ronghua Chen (Xi’an Jiaotong Univ)

Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—I

Session Organizers: Rodolfo Vaghetto (TAMU), Lewis Lommers (Framatome)

Cochairs: Lew Lommers (Framatome), Thien Nguyen (TAMU)

Design of a Scaled Air Ingress Facility for VHTR Accident Analysis

Z. Welker, A. Manera, V. Petrov (Univ of Michigan)

Numerical Simulation on High Temperature Gas-Cooled Reactors on Less of Coolant Accident

Shuangbao Zhang, Liangxing Li, Wei Xie, Kailin Wang (Xi’an Jiaotong Univ)

Thermal Hydraulics in Small Modular Reactors and Micro Reactors—III

Session Organizer: Milorad Dzodzo (Westinghouse)

Cochairs: Jun Liao (Westinghouse), Graham Macpherson (Frazer-Nash Consultancy)
Development of Modeling Framework for High-Temperature Heat Pipes in Micro Reactors

Shanbin Shi (RPI), Yang Liu (Virginia Tech), Piyush Sabharwall (INL)

Significance of Modeling Specific Geometry in Post-Accident Nuclear Aerosol Transport

Rohan M. Biwalkar, Sola M. Talabi (Pittsburgh Technical LLC)

Phenomena Identification and Ranking Table for the eVinci™ Micro Reactor

Richard F. Wright, Andrew M. Dokmanovich (Westinghouse)

Experimental Measurement Techniques and Flow Visualization—VI

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Yang Liu (VT), Ran Kong (Purdue U)

POD Analysis of the Shell-Side Local Flow in a Five-Rod Helical Coil Steam Generator

Saya Lee, Marilyn Delgado, Yassin A. Hassan (Texas A&M)

Artificial Neural Network Method for Automatic Mask Generation for PIV: Applications in a 5x5 Rod Bundle with Mixing Vane Spacer Grids

Gabriel C. Q. Tomaz, Camila F. Matozinhos, Thien Nguyen, Yassin Hassan (Texas A&M)

High-Resolution Velocity Measurements in the Vicinity of a Customized Spacer Grid with Rod Bundle Using Matching Index of Refraction and Particle Image Velocimetry

Camila Freitas Matozinhos, Gabriel Caio Queiroz Tomaz, Mason Childs, Thien Nguyen, Yassin Hassan (Texas A&M), Andre A. Campagnole dos Santos (Centro de Desenvolvimento da Tecnologia Nuclear)
Natural Convection and Mixing Phenomena, Modeling and Experiments—II

Session Organizer: Etienne Studer (CEA)

Cochairs: Alessandro Del Nevo (ENEA), Martin Sonnenkalb (GRS)

5927 Experiment on Density Stratification Behavior by Containment Venting Using CIGMA Facility

Masahiro Ishigaki, Satoshi Abe, Yasuteru Sibamoto, Taisuke Yonomoto (JAEA)

5941 An Evaluation of External Reactor Vessel Cooling in SMART

Hyung Seok Kang, Donggun Son, Sang Mo An, Rae-Joon Park (KAERI)

5955 Experimental Study of Natural Convection Heat Transfer Phenomena in a Two-Layer Corium Pools

Yukun Zhou, Yapei Zhang, Zhiyu Yu, Shihao Wu, Wenxi Tian, Suizheng Qiu, G. H. Su, Ronghua Chen, Simiao Tang (Xi’an Jiaotong Univ)

Plant System Code Validation—IV

Session Organizer: Kent Welter (NuScale)

Cochairs: Kent Welter (NuScale), Seth Cadell (OSU)

5963 Verification of SAC-3D Based on EBR-II SHRT-45R Benchmark Data

Daogang Lu, Siyu Lyu, Danting Sui (North China Electric Power Univ)
Validation of a Drift-Flux Model Used in the CATHARE Code for Rod Bundle Geometry at Low Pressure and Low Liquid Flow Conditions

T. Lopez, L. Matteo (CEA), Dominique Bestion (Consultant)

 Fluid-Structure Interactions—III

Session Organizer: Afaque Shams (NRG)

Cochairs: Afaque Shams (NRG), Daniele Vivaldi (IRSN)

Time-Resolved Particle Image Velocimetry Between Two PWR Sub-Bundles

P. M. Bardet (George Washington Univ), F. Bazin, L. Longo, R. Capanna, G. Ricciardt (CEA)

Structural and FSI Modeling Approach in Accident Analysis for a Framatome BWR Fuel Design

B. Dressel, Sz.Kovacs (Framatome GmbH), invited

A Preliminary Study of Thermal Oscillations Induced by Dryout in Printed Circuit Steam Generator (PCSG)

Jin Su Kwon, Jeong Ik Lee (KAIST), Sang Ji Kim (KAERI)

THURSDAY, AUGUST 22, 2019, 1:20 P.M.

Keynote Session—XVI

Session Organizer and Chair: Brian Jackson (Kairos)
Multi-Scale and Multi-Physics Nuclear Reactor Simulation for the Next Generation LWR Safety Analysis

Han Young Yoon, Ik Kyu Park, Jae Ryong Lee, Yunje Cho, Seung-Jun Lee (KAERI), Hyoung Kyu Cho (Seoul Natl Univ), Jae June Jeong (Pusaj National Univ), invited

Keynote Session—XVII

Session Organizer and Chair: Izabela Gutowska (OSU)

Kairos Power Thermal Hydraulics Research and Development

Edward Blandford, Kyle Brumback, Lambert Fick, Craig Gerardi, Brandon Haugh, Elizabeth Hillstrom, Kevin Johnson, Per F. Peterson, Floren Rubio, Fatih S. Sarikurt, Sonat Sen, Haihua Zhao, Nicolas Zweibaum (Kairos Power), invited

THURSDAY, AUGUST 22, 2019, 2:20 P.M.

Multiscale Multiphysics Applications in Thermal Hydraulics—IV

Session Organizer: Bao-Wen Yang (XJTU)

Cochairs: Marco Pellegrini (IAE), Xiaoying Zhang

A Two-Phase Flow Model for Use in MAMBA; The CRUD Deposition Code

A. Huxford, V. Petrov, A. Manera (Univ of Michigan)

A Data-Driven Approach to Scale Bridging in System Thermal-Hydraulic Simulation

Han Bao, Robert Youngblood, Hongbin Zhang (INL), Nam T. Dinh, Linyu Lin (NCSU), Jeffrey W. Lane (Zachry Nuclear Eng Inc.)
6083 Investigation of Scaling Distortions for NRELAP5 Model of NIST Facility Realized Using the Dynamical Systems Scaling Methodology

Stephen A. Heagy, Cesare Frepoli (FPoliSolutions LLC), Jose N. Reyes (NuScale Power)

6096 Hot Channel Factor Evaluation for Sodium-Cooled Fast Reactors with Multi-Physics SHARP Toolkit

Yiqi Yu, Emily R. Shemon, Taek K. Kim, Elia Merzari (ANL)

Two-Phase Flow and Heat Transfer Fundamentals—III

Session Organizer: Dillon Shaver (ANL)

Cochairs: Jun Fang (ANL), Guillaume Bois (CEA)

6110 Non-Intrusive Two-Phase Flow Regime Identification Method Using FIV and Machine Learning

Shuichiro Miwa, Shuhei Torisaki (Hokkaido Univ)

6117 A Novel Method for Predicting Power Transient CHF via the Heterogeneous Spontaneous Nucleation Trigger Mechanism

Emory Brown, Yikuan Yan, Wade Marcum (OSU)

6130 Experimental Characterization of Boiling Two-Phase Flow Structures Under BWR Core Operating Conditions

J.-M. Le Corre (Westinghouse)

Containment Analysis—I

Session Organizer: Bao-Wen Yang (XJTU)
CoChairs: Sofiane Benhamadouche (EDF), Sanjeev Gupta (Becker Technologies)

6149 **Modeling Approach of Flowing Condensate Coverage on Inclined Wall for Aerosol Wash Down**

Fangnian Wang, Xu Cheng (KIT)

6163 **CFD Analysis of SETH-2 Test Series Using CUPID Code**

Daegwang Hong (KINGS, KEPCO Nuclear Fuel), Donghyun Cho (KINGS, KEPCO E&C), Sang Yong Lee (KINGS), Aya Diab (KINGS, Ain Shams Univ)

6176 **Post-Test Calibration of the Effective Momentum Source (EMS) Model for Steam Injection Through Multi-Hole Spargers**

Xicheng Wang (KTH/Tsinghua Univ), Ignacio Gallego Marcos, Dmitry Grishchenko, Pavel Kudinov (KTH)

6190 **Pre-Test Analysis for HYMERES-2 PANDA Tests Series for Steam Injection into Pool Through Spargers**

Xicheng Wang (KTH/Tsinghua Univ), Ignacio Gallego Marcos, Dmitry Grishchenko, Pavel Kudinov (KTH)

**Accuracy and Uncertainty Analysis—IV**

Session Organizer: Jinbiao Xiong (SJTU)

CoChairs: Ki-Yong Choi (KAERI), Mathieu Martin (TerraPower)

6204 **Quantification of Uncertainty in Pressure Loss Associated with Manufacturing Tolerances in Nuclear Fuel Assemblies**

George Bache (Framatome), Klaus Vogel (Framatome GmbH), Benjamin Farges (Framatome SAS), Lise Charlot (Framatome)
Uncertainty Quantification on SAM Simulations of EBR-II Loss-of-Flow Tests

Travis Mui (Univ of Illinois/ANL), Rui Hu, Guanheng Zhang (ANL)

Comparison of Random and Deterministic Sampling Methods for Quantification of the Input Uncertainty in CFD

A. Cutrono Rakhimov D. C. Visser, E. M. J. Komen (NRG)

Model and Boundary Uncertainty Analysis of PWR LBLOCA Transient Event in RELAP5/MOD3.3 Code

Chih-Chia Chiang, Hao-Chun Chang (Natl Tsing Hua Univ), Jong-Rong Wang, Chunkuan Shih (Nuclear and New Energy Education and Research Foundation), Shao-Wen Chen, Yu-Ming Feng (Natl Tsing Hua Univ)

Multifield Two-Phase Flow Modeling—I

Session Organizer: Caleb Brooks (Univ of Illinois)

Cochairs: Jean-Marie Le Corre (Westinghouse), Dillon Shaver (ANL)

Four Field Flow Modeling of Forced Convective Boiling

T. D. Strayer, G. M. Burdick, R. W. Dacus, T. Gallaway, B. L. Magolan, B. M. Waite (NNL)

Development of the CATHARE 3 Three-Field Model for Simulations in Large Diameter Horizontal Pipes

Philippe Fillion (CEA)

Current Intergroup Mass Transfer Limitations in the Multi-Group Two-Fluid Model

Longxiang Zhu (Univ of Illinois/Xi’an Jiaotong Univ), Zhiee Jhia Ooi, Caleb S. Brooks (Univ of Illinois)

Validation of Interfacial Area Concentration Approaches for Prediction of Gas-Dispersed Condensing Flows
Visualization Experiment for Convective Heat Transfer in a Rectangular Riser of Air-Cooled Reactor Cavity Cooling System

Sin-Yeob Kim, Goon-Cherl Park, Hyoung Kyu Cho (Seoul Natl Univ), Chan Soo Kim (KAERI), Goon-Cherl Park, Hyoung Kyu Cho (Seoul Natl Univ)

Improvement of GAMMA+ for Turbulent Mixed Convection of Air in a Vertical Duct of Reactor Cavity Cooling System

Dong-Ho Shin, Sin-Yeob Kim, Goon-Cheryl Park, Hyoung Kyu Cho (Seoul Natl Univ), Chan Soo Kim (KAERI)

CFD Assessment of LOFA Intra Core Natural Circulation in the High Temperature Test Facility

Izabela Gutowska, Brian G. Woods (OSU)

Experimental Measurement Techniques and Flow Visualization—VII

Session Organizers: Philippe Bardet (George Washington Univ), Xiaodong Sun (Univ of Mich)

Cochairs: Jinhiao Xiong (SJTU), Shanbin Shi (RPI)
Simultaneous Measurements of Temperature and Velocity by Optical Methods in Mixing Jets

Mira Chitt, David Guenadou, Lionel Rossi (CEA)

TDLAS Diagnostic for Investigation of Steam Ingress Accident in HTGRs

Michael C. Button, Philippe M. Bardet (George Washington Univ)

Experimental Investigation on Turbulence Flow Downstream a Spacer Grid with Split-Type Mixing Vanes in a 5x5 Rod Bundle Using PIV

Wenhai Qu, Jindiao Xiong, Xu Cheng (Shanghai Jiao Tong Univ)

Development of Aqueous Molecular Tagging Velocimetry to Measure Wall Shear Stress

C. Fort, M. A. André, P. M. Bardet (George Washington Univ)

Advanced Design Features for Severe Accidents Mitigation—1

Session Organizer: Sung Joong Kim (Hanyang Univ)

MAAP5 Passive Containment Cooling System Model for Korean Advanced Power Reactor Plus

Byung Jo Kim, Jeongseong Lee, Kyubok Lee (KEPCO E&C), Paul McMinn, Chan Y. Paik (Fauske & Associates, LLC), Thomas Kindred (EPRI)

Mapping Emergency Cooling Water Spray System Test Results to the AP1000® PWR Spent Fuel Pool Physical Layout

Robert N. Pinkston (Westinghouse)

Performance Analysis of External Drywell Cooling on BWR Mark II Drywell Head During a Short-Term Station Blackout Scenario by MELCOR
Debris Bed Cooling—I

Session Organizer: Fulvio Mascari (ENEA)

Cochairs: Peter Pandazis (GRS), Etienne Studer (CEA)

6430 Two-Phase Flow Structure in a Particle Bed Packed in a Confined Channel

Daisuke Ito, Tatsuya Kurisaki, Kei Ito, Yasushi Saito (Kyoto Univ), Yuya Imaizumi, Kenichi Matsuba, Kenji Kamiyama (JAEA)

6440 MELCOR and ASTEC Validation on Prelude Test

J. Duspiva, M. Kotouč (UJV Rez)

Boiling and Condensation Heat Transfer—I

Session Organizer: Fumio Inada (CRIEPI)

Cochairs: Junsoo Yoo (INL), Koji Nishida (INSS)

6454 Assessment of Empirical Models and Uncertainty and Sensitivity Study of a High-Velocity Steam Condensation Experiment with TRACE

W. Jaeger, W. Hering (KIT)

6468 Condensation Heat Transfer of the Steam-Air Mixture on Bundle Heat Exchanger of PCCS (Passive Containment Cooling System)

Byoung-Uhn Bae, Seok Kim, Yu-Sun Park, Kyoung-Ho Kang (KAERI)
Study of the Thermal-Hydraulic Behaviors of an Open-Loop PCCS

Xianmao Wang (China Nuclear Power Technol Research Inst), Jun Wang (Univ of Wisconsin, Madison), Suizheng Qiu (Xi’an Jiaotong Univ)

Thermal Hydraulics of Fluoride Salt-Cooled High-Temperature Reactors

Session Organizer: Edward Blandford (Kairos Power)

Cochairs: Lambert Fick (Kairos), Kyle Brumback (Kairos Power)

Development of a Component-Based Scaling Methodology for Fluoride-Salt-Cooled High-Temperature Reactors

Ishak Johnson, Per Peterson (Univ of California, Berkeley)

Numerical Verification of the Kairos Power Systems Code KP-SAM

Lambert H. Fick, Haihua Zhao (Kairos Power)

Scaling Methodology for Integral Effects Tests in Support of Fluoride-Salt-Cooled, High-Temperature Reactor Technology

Nicolas Zweibaum, Edward Blandford, Craig Gerardi, Per Peterson (Kairos Power)

Overview of Kairos Power Systems Code KP-SAM Development

Haihua Zhao, Lambert Fick, Justin Herter, Brandon Haugh (Kairos Power)

THURSDAY, AUGUST 22, 2019, 4:20 P.M.

Containment Analysis—II

Session Organizer: Bao-Wen Yang (XJTU)
Cochairs: Sanjeev Gupta (Becker Technologies), Zhiwei Zhou (Tsinghua University)

6551 **A Mechanistic Spray Model for Lumped Parameter Reactor Containment Modeling**

*D. Bestion (Consultant), T. Lopez (CEA)*

6564 **Development and First Validation of the Tailored CFD Solver ‘ContainmentFoam’ for Analysis of Containment Atmosphere Mixing**

*S. Kelm, M. Kampili (FzJ), G. Vijaya Kumar (FzJ/ Indian Inst of Technol Madras), Kinshiro Sakamoto (FzJ/Fukui Univ), X. Liu, C. Druska, A. Kuhr (FzJ), K. Arul Prakash (Indian Inst of Technol Madras), H.-J. Allelein (FzJ)*

6579 **Improvement of Physical Modeling for Coupled Heat and Mass Transfer in a Square Cavity with Condensation in the Presence of Non-Condensable Gas**

*Nan Jiang, Etienne Studer (DEN/STMF, CEA, Université Paris-Saclay), Bérengère Podvin (LIMSI, CNRS, Université Paris-Saclay)*

**Plant System Code Analysis and Development—III**

**Session Organizer: Mathieu Martin (TerraPower)**

**Chair: Wade Marcum (OSU)**

6593 **Mesh Sensitivity Analysis of 1-D Nuclear System Analysis Code with Higher-Order Numerical Scheme**

*Wonwoong Lee, Jae Jun Lee, Sung Gil Shin, Jeong Ik Lee (KAIST)*

6604 **Comparisons of Friction Models Implemented in U.S. TRACE and Korean MARS-KS System TH Codes**
Sung Gil Shin, Jeong Ik Lee (KAIST)

**Multifield Two-Phase Flow Modeling—II**

**Session Organizer:** Caleb Brooks *(Univ of Illinois)*

**Cochairs:** Shanbin Shi *(RPI)*, Subash Sharma *(Purdue University)*

6618 Development of a Droplet Entrainment Correlation for a Vertical Upward Annular-Mist Flow

Jee Min Yoo, Kum Ho Han, Jae Jun Jeong *(Pusan National Univ)*, Han Young Yoon *(KAERI)*

6632 Study on Evaluation Method for Entrained Gas Flow Rate by Free Surface Vortex

Kei Ito, Daisuke Ito, Yasushi Saito *(Kyoto Univ)*, Toshiki Ezure, Kentarou Matsushita, Masaaki Tanaka *(JAEA)*, Yasutomo Imai *(NDD Corp.)*

6643 Validation of the Interfacial Area Transport Equation Coupled with the Void Transport Equation for Prediction of Flashing Flows

Zhiee Jhia Ooi, Vineet Kumar, Caleb S. Brooks *(Univ of Illinois)*

**Thermal Hydraulics in High-Temperature Gas-Cooled Reactors—III**

**Session Organizers:** Rodolfo Vaghetto *(TAMU)*, Lewis Lommers *(Framatome)*

**Cochairs:** Lew Lommers *(Framatome)*, Izabela Gutowska *(OSU)*

6655 Discrete Element Modeling of Conduction Cool Down in Pebble-Bed Reactors Under Loss of Forced Convection
Dan Gould (General Atomics-ASI), Mary Ross, Hitesh Bindra (Kansas State Univ)

6669 Velocimetry/Thermometry Data Fusion from DCC Tests in the HTTF

M. A. André, P. M. Bardet (George Washington Univ), S. R. Cadell, B. Woods (OSU)

6679 Standard Fuel Block Test to Validate Core Thermo-Fluid Analysis Code for Prismatic Gas-Cooled Reactor

Chan Soo Kim, Byung Ha Park, Eung Seon Kim (KAERI)

Thermal Hydraulics in Small Modular Reactors and Micro Reactors—IV

Session Organizer: Milorad Dzodzo (Westinghouse)

Cochairs: Kent Welter (NuScale), Richard Wright (Westinghouse)

6690 LOCA-Type Scenario Simulation for NuScale-SMR with RELAP/SCDAPSIM/MOD3.4

Katarzyna Skolik (AGH Univ of Science and Technology), Anuj Trivedi, Marina Perez-Ferragut, Chris Allison (Innovative Systems Software)

6701 Validation of the Trace Code Against Small Modular Integral Reactor Natural Circulation Phenomena

F. Mascari (ENEA), B. G. Woods (OSU), K. Welter (NuScale Power), F. D’Auria (Univ of Pisa)

6715 Scaling Effects of Film Flow Regimes in SMR Integral Tests

Dongyoung Lee, Qiao Wu (OSU)

Advanced Design Features for Severe Accidents Mitigation—II

Session Organizer: Fulvio Mascari (ENEA)
Chair: Etienne Studer (CEA)

6727 Surface Characteristics of Accident Tolerant Fuels Cladding and Their Potential Impact in Critical Heat Flux

Rajnikant Umretiya, Daniel Ginestro, Sama Bilbao y Leon, Jessika Rojas (Virginia Commonwealth Univ), Barret Elward, Mark Anderson (Univ of Wisconsin, Madison), Raul B. Rebak (GE Global Research)

6741 A Study on Safety Margin of In-Vessel Melt Retention for VVER1000 Reactor

Long Manh Doan, Tran Chi Thanh (Viet Nam Atomic Energy Inst), Nguyen Van Thai (Hamoi Univ of Science and Technology)

Debris Bed Cooling—II

Session Organizer: Etienne Studer (CEA)

Chair: Didier Jacquemain (IRSN)

6755 Analytical Transient Two-Phase Model for Dry-Superheated Debris Bed Under Top Flooding Conditions

Alejandro Villarreal Larrauri, Renaud Meignen (IRSN), Michel Gradeck, Nicolas Rimbert (LEMTA CNRS, Univ of Lorraine)

6770 Development of Surrogate Model for Debris Bed Coolability Analysis

Yangli Chen, Weimin Ma (KTH)

Boiling and Condensation Heat Transfer—II
Session Organizer: Fumio Inada (CRIEPI)

Cochairs: Atsushi Ui (CRIEPI), Wadim Jaeger (KIT)

6780 Force Balance Model Assessment for Mechanistic Prediction of Sliding Bubble Velocity in Vertical Subcooled Boiling Flow

Junsoo Yoo (INL), Yassin A. Hassan (Texas A&M)

6794 TRACE High Pressure Condensation Model Validation Using KAIST Data

J. Thompson, P. Lien (NRC)