18th International Topical Meeting on Nuclear Reactor Thermal Hydraulics 2019 (NURETH 2019)

Portland, Oregon, USA
18 – 23 August 2019

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1876A Preliminary Study On Biphilic Surface for Enhanced Pool Boiling Performance

Do Yeong Lim, In Cheol Bang (UNIST)

1882Modelling Path of the Heterogeneous Spontaneous Nucleation—A New Driven Mechanism of Power Transient CHF

Yikuan Yan, Emory Brown, Wade Marcum (OSU)

1893An 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)

1907Boiling 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)*

1917EDF MAAP5.04 LOCA Transient Simulations Improvements

Jeremy Bittan (EdF)

1931Uncertainty Analysis of Severe Accident in the Spent Fuel Pool

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

1944Uncertainty Analysis of Vessel Failure Mode and Melt Release in Station Blackout Scenario in Nordic BWR Using MELCOR Code

Sergey Galushin, Pavel Kudinov (KTH)

1957The 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)*

1971Status 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)

1985Applicability 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.)

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

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

2012Determination 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)*

2023Validation 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)

2036Validation 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)

2050CFD 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)*

2064Toward 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)*

Keynote Session—VII

    Session Organizer and Chair: *Ferry Roelofs (NRG)*

Computational Multi-Fluid Dynamics—V

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

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

J. Peltola, T. Pättikangas (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 Tennesse, Knoxville)

Computational Fluid Dynamics—V

Session Organizer: *Jinyong Feng (MIT)*

Cochairs: *Rui Hu (ANL), Yiqi Yu (ANL)*

2209Comparison 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)

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

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

2235Parametric 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)*

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

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

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

Ibrahim Jarrah, Rizwan- Uddin (Univ of Illinois)

2274Critical 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-UNPI), 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)

2288Simulation 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)*

2302Experimental Study of the Surface Evaporation Rate of a Heated Water Pool Using Infrared Thermography

J. Martin, B. Migot (IRSN)

2314Quenching Experiment of Cr-Alloy Accident Tolerant Cladding Under Low and High Subcooling Conditions

Wang Kee In, Kwan-Geun Lee (KAERI)

2324Velocity- and Scalar-Field Measurements of Turbulent Buoyant Jets in a Two-Layer Stratified Environment

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

2338Intelligent 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

M. Anderhuber, A. Gerschenfeld, Y. Gorsse, N. Alpy C. Latge, J. Perez-Manes (CEA), Yu. Kuzina, A. Sorokin, I. Berensky, A. Volkov, Yu. Chernukhina, K. Raskach (IPPE)

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)

2398Experimental 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)

2411Characterization 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.),

2425Numerical Analysis of the Axial Lead-Bismuth Pump Performace Base 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 Electo-Communications)*

2439Infrared 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)

2447Enhancement 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)

2461Dependence 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. Droin, 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)*

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

R. Mukin, I. Clifford, O. Costa Garrido, D. F. Mora, M. Niffenegger, B. Niceno, H. Ferroukhi (PSI)

2550RELAP5-3D 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 Eletations

Alex Matev (BEL V)

2564Thermal 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: *Hyoung Kyu Cho (Seoul Natl Univ), Victor Petrov (Univ of Mich)*

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

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

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

C. Ghitiu, E. Demay (EdF SA), E. Studer, D. Abdo, P. Debesse, B. Cariteau, G. Bernard-Michel, F. Dabbene (CEA)

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)

2686 [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)*

2686Analysis of Wall Nucleation Modeling for Flow Boiling in Fluent

Longcong Wang, Caleb S. Brooks (Univ of Illinois)

2699Development 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)

2713A 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)*

2726Experimental Design for Transient in-Pile Boiling Studies at the TREAT Facility

Colby Jensen, Nicolas Woolstenhulme, Charles Folsom, David Kamerman, Austin Fleming, Daniel Wachs (INL)

2738Thermal Design of the TREAT Facility

Bradley Heath, Colby Jensen (INL)

2750Visual Inspection to Monitor / Detect Boiling

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

2762Comparison 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)*

2772Optimization 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)

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

Junsoo Yoo (INL), Emilio Baglietto (MIT)

2795Accuracy 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)*

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

N. O. Cetiner, S. M. Cetiner, M. J. Roberts, V. K. Varma, G. Muralidharan, T. R. Muth, R. A. Montogomery (ORNL)

2818Experimental 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)

2826Experimental 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)*

2840 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)

2850 Natural Convection of a Droplet-Laden Flow in a Cylindrical Enclosure Above a Hot Sodium Pool

Xiaoxue Huang, Shuisheng He (Univ of Sheffield)

2864 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)*

2878 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)

2892 Advancing Radiative Heat Transfer Modeling in High-Temperature Liquid-Salts

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

2905 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)*

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

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

2930Effect 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)*

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

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

2955Risk-Informed Safety Analysis for Accident Tolerant Fuels

C. Parisi, Z. Ma, D. Mandelli, N. Anderson, H. Zhang (INL)

2969Transient 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)*

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

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

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

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

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

D.-J. Euh (KAERI/Univ of Science and Technol), K. H. Kim, W. M. Park, H. S. Choi,Y. J. Youn (KAERI)S. S. Lee, S. K. Lim, H. D. Lee (Korea Hydro & Nuclear Power Co.), T. S. Kwon (KAERI)

Computational Fluid Dynamics V&V—III

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

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

3014Assessment, 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)

3030The 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)

3042Validation 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)*

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

Jean Baccou (IRSN), Jinzhao Zhang (Tractebel Engineering S.A.), Philippe Fillion, 27645Guillaume 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)

3068Nuscale 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)*

3078 Departure from Nucleate Boiling (DNB) Simulations Base on an Interface Tracking Method

Y. Sato, B. Niceno (PSI), B. L. Smith (Goldsmith Transactions), invited

Keynote Session—IX

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

3092 MultiPhysics for Nuclear Energy Applications Using a Cohesive Computational Framework

R. Martineau, D. Andrs, R. Carlsen, D. Gaston, J. Hansel, F. Kong, A. Lindsay, C. Permann, A. Slaughter (INL), E. Merzari, Rui Hu (ANL), A. Novak, R. Slaybaugh (Univ of California, Berkeley), invited

Keynote Session—X

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

3107 Status and Challenges of SCWR Thermal Hydraulics Research in China

Xiaojing Liu (Shanghai Jiao Tong Univ), Xu Cheng (KIT), invited

Keynote Session—XI

Session Organizer and Chair: ***Wade Marcum (OSU)***

3126 Severe Accident Phenomena: A Comparison Between NuScale, Other Advanced LWRs, and Existing LWRs

Scott J. Weber, Etienne M. Mullin (NuScale Power, LLC)

WEDNESDAY, AUGUST 21, 2019, 8:20 A.M.

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)

3154 CFD Prediction of Ultra-High Critical Heat Flux for Subcooled Water Flow Boiling in a Vertical Tube

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 (XJTU), Jinyong Feng (MIT)*

3195A CFD Study on the Hydrodynmics for Tandem Plate Configurations Under Turbulent Flow

Wade Marcum, Jonathan Gjemso (OSU)

3206CFD 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)

3219Framatome'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)

3233Thermal Analysis for eVinci^{TM} 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)*

3243Numerical Simulation of Penetration Flow into T-Junction Branch Lines

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

3257Statistical Emulator Models for Scalar Mixing in Reactor Safety Analysis

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

3270Universal Digital Nuclear Reactor System (UNDREAS)

Chirayu Batra, Vladimir Kriventsev (IAEA)

3280Numerical 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)*

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

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

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

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

3315Propagation 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)*

3329Development of a Polyhedral Staggered Mesh Scheme Application to Subchannel and CFD SFR Thermal Hydraulics

Antoine Gerschenfeld, Yannick Gorsse, Gauthier Fauchet (CEA)

3343Visualization 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)

3355Study 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 Cooporation)

3364Experimental 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)*

3378Heat 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)

3391The Preliminary Safety Analysis of a s-CO$_2$ Brayton Cycle Cooled Reactor System

Chuntian Gao, Pan Wu, Jianqiang Shan (Xi'an Jiao Tong Univ)

3402A 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)*

3416PIV Refinement Using Optical Flow for High Resolution Flow Measurement: Development and Preliminary Validations

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

3430Accelerating Infrared Boiling Heat Transfer Studies with Online Machine Learning Capabilities

M. Ravichandran, M. Bucci (MIT)

3443Experimental 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)*

Modeling and Experiments of Severe Accidents—I

Session Organizer: *Guillaume Mignot (OSU)*

Cochairs: *Nathan Andrews (SNL), Sung Joong Kim (Hanyang Univ)*

Experiments and Data Bases for Assessment and Validation—III

Session Organizer: *Richard Schultz (ISU)*

Chair: *Victor Petrov (Univ of Mich)*

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

H. F. P. Castro (UFMG), G. A. M. Vidal, T. A. S. Vieira, V. V. A. Silva, D. A. M.Campolina, G. P. Barros (CDTN), M. A. F. Veloso (UFMG), A. A. dos Santos (CDTN)

3542Validation 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)

3554High-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)*

3568CFD Validation of Buoyancy Driven Jet Spreading, Mixing and Wall Interaction

Graham Macpherson (Frazer-Nash Consultancy), Ryan Tunstall (Rolls-Royce)

3582Uncertainty 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)

3598Verification 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)*

3612Modeling 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)

3624Evaluation 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)

3637Numerical 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)*

3649Progress 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)

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

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

3677Simulations 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)

3689Numerical 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)*

3705Application of the COBRAG Subchannel Code to Fuel Design

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

3719Transient Subchannel Analysis of BWR Fuel Thermal Hydraulic Performance

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

3732Experimental 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)*

3741Hybrid Nodal Integral -Finite Element Method (NI-FEM) for 2D, Time-Dependent Burgers' Equation in Arbitrary Geometries

Sundar Namala, Rizwan-Uddin (Univ of Illinois)

3756Application 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)

3770Density 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

Session Organizer: *Mathieu Martin (TerraPower)*

Chair: *Brian Jackson (Kairos Power)*

3779Remaining 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)

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

T. Chen, Wade Marcum (OSU)

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

T. Chen, W. Marcum (OSU)

3820SPH 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

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

Chair: *Olu Omotowa (TerraPower)*

3833Improved Design of Spent Fuel Dry Storage Using Phase Change Heat Transfer of Hybrid Control Rod-Heat Pipe

Kyung Mo Kim, In Cheol Bang (UNIST)

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

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

3856Buoyancy-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)*

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

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

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

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

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

A. J. Brunett, T. Q. Hua, G. Hu, R. Hu, T. H. Fanning, G. Zhang (ANL)

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)*

3908Transient Analysis of an FHR Coupled to a Helium Brayton Power Cycle

Guolei Zhang (Harbin Eng Univ), Minghui Chen, Xiaodong Sun (Univ of Michigan)

3922Molten Salt Coolant Modeling In TRACE

Glenn Roth, Jay Spore (Information Systems Laboratories)

3931CFD Simulation of Xenon Removal by Helium Bubble Sparging in Molten Salt

Jiaqi Chen, Caleb S. Brooks (Univ of Illinois)

3945Flow 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)*

3955Uncertainty 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)

3968<u>Characterization of Liquid Jet Breakup for the Simulation of Accidental Sodium Leakage Scenarios in Sodium-Cooled Fast Reactors</u>

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

3978<u>Important Issues in Validation of Computational Fluid Dynamics Codes Against CFD Grade Experimental Results</u>

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

3989<u>Preliminary Results on the Development of a Fast-Neutron Tomography System for Void Fraction Distribution Measurements</u>

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

<u>Fuel Coolant Interaction, Modeling and Experiments—I</u>

<u>Session Organizer:</u> *Etienne Studer (CEA*

<u>Cochairs: *Jeremy Bittan (EDF), Fulvio Mascari (ENEA)*</u>

4004<u>Ex-Vessel Fuel Coolant Interaction Experiment with the Geometry of an AP1000 Reactor</u>

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

4018<u>Premixed Layer Formation Modelling in Stratified Melt-Coolant Geometry</u>

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

4032<u>Risk of Containment Failure Due to Ex-Vessel Steam Explosion for Nordic BWRs</u>

Dmitry Grishchenko, Sergey Galushin, Pavel Kudinov (KTH)

4039<u>Melt Droplet Fragmentation Behavior During Fuel-Coolant Interaction</u>

Gen Li, Haobo Feng, Panpan Wen, Jun Zhang, Jinshi Wang, Junjie Yan (Xi'an Jiaotong Univ)

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)

4098Digitilization 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)*

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

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

4123Application 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)

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

David Pialla, Marc Ludmann, Karine Vareille (EdF)

4150A 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)*

4164Multiscale 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)*

4178Molecular 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)*

4184Overview of Thermal-Hydraulic Validation Tests with SMART-ITL to Support SMART Pre-Project Engineering

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

4197Comparison 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)

4211Hot Spot Temperature Prediction for a Micro Modular High Temperature Gas-Cooled Reactor

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

4219Development 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)*

4233Flow Dynamic Behavior in Rod Bundles: An Experimental Assessment

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

4246Effect of Part-Length Rods and Transient Flow for Different BWR Subchannel Geometries

Lukas Robers, Horst-Michael Prasser (ETH Zürich)

4260Unsteady 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)

4273Experimental 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)*

4287A 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)

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

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

4310Chimney 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)*

4324CFD Analysis of Hydrogen Flame Acceleration with Burning Velocity Models

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

4336Numerical 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)

4348Development 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)

4362Numerical 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)*

4372Preliminary RELAP5 System Analysis of the Water-Based NSTF—Part 1: Model Development

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

4388Preliminary RELAP5 System Analysis of the Water-Based NSTF—Part 2: Parametric Study

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

4406Turbulent 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 Gershcenfeld (CEA), Adam Kraus (ANL)*

4418Onset 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)

4430Modelling 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)

4443Oscillation 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)*

4457 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)

4470 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)

4484 Progess 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)*

4498 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)

4505 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)

4518 Ultrasound Measurement of Upward Liquid Film Flow in Vertical Pipe

Yuki Wada, Akira Satou, Yasuteru Sibamoto, Taisuke Yonomoto (JAEA), Jun Sagawa (Mito Electronic Solution)

4532 High-Fidelity Velocity Measurements in a Totally Blocked Subchannel of a Wire-Wrapped 61-PIN Hexagonal Fuel Bundle

L. A. Lance, Nolan Goth White, Jake Pettyjohn, D. T. Nguyen, R. Vaghetto, Y. A. Fuel Coolant Interaction, Modeling and Experiments—IIHassan (Texas A&M)

Fuel Coolant Interaction, Modeling and Experiments—II

Session Organizer: *Guillaume Mignot (OSU)*

Chair: *Yu Maruyama (JAEA)*

4542 New Film Boiling Correlations for Drops and Fragments in Fuel Coolant Interaction Codes

E. De Malmazet (EdF)

4556 Effects of Salinity in Coolant on Steam Explosion

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

4568 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)*

4575 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)

WEDNESDAY, AUGUST 21, 2019, 4:20 P.M.

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)*

4681A 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)

4690Applicability 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)*

4704Critical Heat Flux Model for Vertical Annular Mist Flow Conditions in a Rod Bundle

José N. Reyes, Jr. (NuScale Power)

4720A 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)

4732Mapping 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)***

4741Investigations 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)

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

Javier Martinez, Elia Merzari (ANL)

4769Subchannel 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)*

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

Michael Acton, Emilio Baglietto (MIT)

4795Inverse 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)

4808A 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)*

4817About Phenomena Identification in a PIRT

D. Bestion (Consultant)

4831Analytical 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)*

4841Transient Analyses of the Versatile Test Reactor Using RELAP5-3D

C. Parisi, C. Davis, G. Youinou (INL)

4854Modelling Thermal Stratification in Upper Plenum of Sodium Fast Reactor Using Systems Code SAS4A/SASSYS-1 and Using CFD

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

4864Validation 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)*

4876Molten Salt to Supercritical CO_2 Diffusion-Bonded Heat Exchanger Testing to Support Component Certification for Advanced Nuclear Power Systems

Shaun R. Aakre, Mark H. Anderson (Univ of Wisconsin, Madison)

4888Triple Flow Heat Exchanger with Intermediate Oval Twisted Tube for FHRs

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

48993D 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)*

4912Application of Strain Gages in a Highly Advective Environment for Measurement of Fluid-Structure Interactions

A. W. Weiss, W. R. Marcum (OSU), W. F. Jones, A. M. Phillips, T. V. Holschuh (INL), T. K. Howard (ORNL)

4926An Approach to Instrumenting a Full-Scale 61-Pin Hexagonal Fuel Bundle for Flow-Induced Vibration Testing

C. A. Nixon, W. R. Marcum, A. W. Weiss (OSU), K. M. Steer, R. B. Jackson, M. G. Martin, C. Yeager (TerraPower)

Fuel Coolant Interaction, Modeling and Experiments—III

Session Organizer: *Sung Joong Kim (Hanyang Univ)*

Chair: *Alessandro Del Nevo (ENEA)*

4934Investigation on the Characteristics of Melt Jet Breakup in Water with Both Experiment and LBM Methods

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

4948Fuel-Coolant Interaction Modeling Supporting TREAT Experimental Analysis

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

4961Experimental Study on the Molten Materials Effect in Fuel-Coolant Interaction

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

4971Parametic 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)*

4983Developing Separate Effects Transient Test Experiments Using an Out-of-Pile Flowing Water Loop

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

4994Study on Fuel Damage Progression and Porosity in the SFD 1-4 Test

K. Nishida, N. Sano, T. Torige, T. Kusunoki, M. Murase (Inst of Nuclear Safety System, Inc.)

5006Heat 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)

5020Inter-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)*

5029H2020 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)

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

S. O. Yu, M. K. Cho, S. C. Song, K. L. Baek (KINS)

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

Atsushi Ui, Yoshiro Kudo, Masahiro Furuya (CRIEPI)

5064Horizontal Stratification and Its Application to PWR LOCA Analysis

Jun Liao (Westinghouse)

Fluid-Structure Interactions—I

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

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

D. De Santis, A. Shams (NRG)

5092Numerical 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)

5103Elastic 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)*

5116Smaller 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)*

5126Challenges in Containment Thermal Hydraulics

E. Studer, D. Abdo, S. Benteboula, G. Bernard-Michel, B. Cariteau, N. Coulon, F. Dabbene, Ph. Debese, S. Koudriakov, C. Ledier, J.-P. Magnaud, O. Norvez, J.-L. Widloecher, A. Beccantini, S. Gounand, J. Brinster (CEA), invited

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)*

5141Fuel Assembly Bow Evaluations with Computed Hydraulic Forces

Robert A. Brewster, Yuriy Aleshin (Westinghouse)

5151Development, Verification and Validation of the Multi-Scale CATHARE—NEPTUNE_CFD Coupling

Clotaire Geffray (CEA), Chaï Koren (EdF R&D)

5165Multi-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)

5179Analyses 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)*

5239Analysis of Sensitivity and Uncertainty Quantification for Transient Simulation with the Emphasis on Changes in the Transient Structure

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

5253Uncertainty and Sensitivity Analysis of the PBF SFD Test 1-4 Using MAAP5 Code

Ikuo Kinoshita (Inst of Nuclear Safety System, Inc)

5264Sensitivity Analysis on the Critical Mass Flowrate Based on Sobol' Indices Through Replicated LHS

Lucia Sargentini, Guillaume Damblin (CEA)

5275A Best-Estimate-Plus-Uncertainty-Based Method for Design and Design Verification

R. P. Martin (BWX Technol)

Fundamental Thermal Hydraulics: General—II

Session Organizer: ***Caleb Brooks (Univ of Illinois)***

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

5285Using Deep Learning for the Development of Critical Heat Flux Models for Pressurized Water Reactors

Otto Linsuaín, Boyan D. Ivanov (Westinghouse)

5299A Correlation of the Water Film Thickness and Friction Factor for Supercritical/Subcritical Transition in a Hot-Leg Pipe Geomtery

S. Al Issa, R. Macian-Juan (Technical Univ Munich)

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

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

Cochairs: *Hitesh Bindra (KSU), Simon Li (CEA)*

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

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

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

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

5334Development 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)*

5342Coupled 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)

5356Experimental 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)

5367Development of a Parametric Computational Fluid Dynamics Model to Estimate Passive Aerosol Decontamination

Rohan M. Biwalkar (Pittsburgh Technical LLC/Carnegie Mellon Univ), Satbir Singh, Nishant Sharma (Carnegie Mellon Univ), Sola M. Talabi (Pittsburgh Technical LLC)

5385Characterization 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)*

5399Detailed 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)

5413Flow 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

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

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

5438Statistical 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^{TM} 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^{TM} 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)*

5503A Two Phase Mathematical Model to Describe the Dissolution of Corium Crust by Molten Steel

Shambhavi Nandan, Florian Fichot, Fabien Duval (IRSN)

5518Experimental Studies on Two-Layer Corium Heat Transfer in Light Water Reactor Lower Head in LIVE2D Facility

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

5530Computational 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)

5544MAAP5 Benchmarking to the TRACE Thermal Hydraulic Tool

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

5559MAAP5-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)*

5575The 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)

5588Test 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)

5599Development 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)*

5616Review Paper on Water Film Characteristics

M. Moustafa, T. Ruifeng (Harbin Eng Univ)

5631Assesment of High Performance Computing for Nuclear Reactor Thermal Hydraulics Applications

Adam Padee, Tomasz Kwiatkowski, Piotr Wasiuk,Tobiasz Jarosiewicz, Sławomir Potempski (National Centre for Nuclear Research), Afaque Shams (NRG)

5639Dynamics 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

Session Organizer: *Bao-Wen Yang (XJTU)*

Cochairs: *Bao-Wen Yang (XJTU), Zhiwei Zhou (Tsinghua University)*

7874Coupled 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)

5667Thermal-Hydraulic Simulation of Advanced Gas-Cooled Reactors Steam Generators Using Coupled Porous CFD and 1D Two-Phase Flow Modelling

A. Toti, J. Uribe (EDF Energy R&D), M. Rabbitt, C. Sigournay, S. Pandit, P. Brown (EDF Energy Nuclear Generation)

5680Preliminary 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

Session Organizer: *Dillon Shaver (ANL)*

Chair: *Caleb Brooks (U Illinois)*

5691Investigation 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)

5763A 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)*

5776Sensitivity Analysis of Minor Leaks in Light Water Reactor Environments

Lukasz Sokolowski (Kiwa Inspecta Nuclear AB)

5790Uncertainty 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)*

5804Experiment and Numerical Simulation of a Single Bubble Formation Under a Downward Face of Different Contact Angels

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

5816 Bayesian Calibration of Empirical Models Common in MELCOR and Other Nuclear Safety Codes

N. W. Porter, V. A. Mousseau (SNL)

5827 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)*

5840 Design of a Scaled Air Ingress Facility for VHTR Accident Analysis

Z. Welker, A. Manera, V. Petrov (Univ of Michigan)

5848 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)*

5862Development of Modeling Framework for High-Temperature Heat Pipes in Micro Reactors

Shanbin Shi (RPI), Yang Liu (Virginia Tech), Piyush Sabharwall (INL)

5876Significance of Modeling Specific Geometry in Post-Accident Nuclear Aerosol Transport

Rohan M. Biwalkar, Sola M. Talabi (Pittsburgh Technical LLC)

5886Phenomena Identification and Ranking Table for the eVinci[TM] 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)*

5894POD 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)

5905Artificial 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)

5913High-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)

5977Validation 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)*

5990Time-Resolved Particle Image Velocimetry Between Two PWR Sub-Bundles

P. M. Bardet (George Washington Univ), F. Bazin, L. Longo, R. Capanna, G. Ricciardt (CEA)

5999Structural and FSI Modeling Approach in Accident Analysis for a Framatome BWR Fuel Design

B. Dressel, Sz.Kovacs (Framatome GmbH), invited

6012A 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)*

6026 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)*

6040 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*

6055 A Two-Phase Flow Model for Use in MAMBA; The CRUD Deposition Code

A. Huxford, V. Petrov, A. Manera (Univ of Michigan)

608; 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.)

60: 5[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)*

6149Modeling Approach of Flowing Condensate Coverage on Inclined Wall for Aerosol Wash Down

Fangnian Wang, Xu Cheng (KIT)

6163CFD 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)

6176Post-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)

6190Pre-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)*

6204Quantification 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)

6217Uncertainty Quantification on SAM Simulations of EBR-II Loss-of-Flow Tests

Travis Mui (Univ of Illinois/ANL), Rui Hu, Guanheng Zhang (ANL)

6230Comparison 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)

6244Model 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)*

6257Four 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)

6271Development of the CATHARE 3 Three-Field Model for Simulations in Large Diameter Horizontal Pipes

Philippe Fillion (CEA)

6283Current 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)

6296Validation of Interfacial Area Concentration Approaches for Prediction of Gas-Dispersed Condensing Flows

Vineet Kumar, Caleb S. Brooks (Univ of Illinois)

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

Session Organizers: *Rodolfo Vaghetto (TAMU), Lewis Lommers (Framatome)*

Cochairs: *Thien Nguyen (TAMU), Aaron Epiney (INL)*

6309Visualization 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)

6323Improvement 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)

6335CFD 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: *Jinbiao Xiong (SJTU), Shanbin Shi (RPI)*

6349Simultaneous Measurements of Temperature and Velocity by Optical Methods in Mixing Jets

Mira Chitt, David Guenadou, Lionel Rossi (CEA)

6357TDLAS Diagnostic for Investigation of Steam Ingress Accident in HTGRs

Michael C. Button, Philippe M. Bardet (George Washington Univ)

6365Experimental Investigation on Turbulence Flow Downstream a Spacer Grid with Split-Type Mixing Vanes in a 5x5 Rod Bundle Using PIV

Wenhai Qu, Jinbiao Xiong, Xu Cheng (Shanghai Jiao Tong Univ)

6388Development 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—I

Session Organizer: *Sung Joong Kim (Hanyang Univ)*

Cochairs: *Nathan Andrews (SNL), Fulvio Mascari (ENEA)*

6395MAAP5 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)

6409Mapping Emergency Cooling Water Spray System Test Results to the AP1000® PWR Spent Fuel Pool Physical Layout

Robert N. Pinkston (Westinghouse)

6418Performance Analysis of External Drywell Cooling on BWR Mark II Drywell Head During a Short-Term Station Blackout Scenario by MELCOR

Miao Gui, Jun Wang, Ryan Dailey, Michael L. Corradini (Univ of Wisconsin, Madison)

Debris Bed Cooling—I

Session Organizer: *Fulvio Mascari (ENEA)*

Cochairs: *Peter Pandazis (GRS), Etienne Studer (CEA)*

6430Two-Phase Flow Structure in a Particle Bed Packed in a Confined Channel

Daisuke Ito, Tatsuya Kurisaki, Kei Ito, Yasushi Saito (Kyoto Univ), Yuya Imaizumi, Ken-ichi Matsuba, Kenji Kamiyama (JAEA)

6440MELCOR 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)*

6454Assessment of Empirical Models and Uncertainty and Sensitivity Study of a High-Velocity Steam Condensation Experiment with TRACE

W. Jaeger, W. Hering (KIT)

6468Condensation 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)

6477 [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)*

6488 [Development of a Component-Based Scaling Methodology for Fluoride-Salt-Cooled High-Temperature Reactors](#)

Ishak Johnson, Per Peterson (Univ of California, Berkeley)

6502 [Numerical Verification of the Kairos Power Systems Code KP-SAM](#)

Lambert H. Fick, Haihua Zhao (Kairos Power)

6516 [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)

6536 [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)*

6551A Mechanistic Spray Model for Lumped Parameter Reactor Containment Modeling

D. Bestion (Consultant), T. Lopez (CEA)

6564Development 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)

6579Improvement 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)*

6593Mesh 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)

6604Comparisons 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)

6669Velocimetry/Thermometry Data Fusion from DCC Tests in the HTTF

M. A. André, P. M. Bardet (George Washington Univ), S. R. Cadell, B. Woods (OSU)

6679Standard 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)*

6690LOCA-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)

6701Validation 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)

6715Scaling 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)*

6727Surface 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)

6741A 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)*

6755Analytical 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)

6770Development 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)*

6780Force Balance Model Assessment for Mechanistic Prediction of Sliding Bubble Velocity in Vertical Subcooled Boiling Flow

Junsoo Yoo (INL), Yassin A. Hassan (Texas A&M)

6794TRACE High Pressure Condensation Model Validation Using KAIST Data

J. Thompson, P. Lien (NRC)