5th Topical Meeting on Advances in Nuclear Fuel Management (ANFM 2015)

Advances in Nuclear Fuel Management V

Hilton Head, South Carolina, USA
29 March - 1 April 2015
New Modeling Concepts, Reactivity Control, Generation of Cross Section Libraries and Whole Core Transport Calculations

60 Fuel Cycle Performance of Intermediate Spectrum Reactors with U/Th Feed and Continuous Recycling of U/TRU and Th/U3
Nicholas R. Brown Michael Todosow ..... pg. 1
Brookhaven National Laboratory, Upton NY

75 Development of a Full-Core Reactivity Equivalence for FeCrAl Enhanced Accident Tolerant Fuel in BWRs
Nathan M. George (1), Jeffrey J. Powers (2), G. Ivan Maldonado (1), Andrew Worrall (2), Kurt A. Terrani (3) ..... pg. 19
1) Department of Nuclear Engineering, University of Tennessee Knoxville, TN, 2) Reactor and Nuclear Systems Division, Oak Ridge National Laboratory, Oak Ridge, TN, 3) Fusion and Materials for Nuclear Systems Division, Oak Ridge National Laboratory

89 Demonstration of a Full-Core Reactivity Equivalence for FeCrAl Enhanced Accident Tolerant Fuel in BWRs
Nathan M. George (1), Jeffrey J. Powers (2), G. Ivan Maldonado (1), Andrew Worrall (2), Kurt A. Terrani (3) ..... pg. 31
1) Department of Nuclear Engineering, University of Tennessee, Knoxville, TN, 2) Reactor and Nuclear Systems Division, Oak Ridge National Laboratory, Oak Ridge, TN, 3) Fusion and Materials for Nuclear Systems Division, Oak Ridge National Laboratory, Oak Ridge, TN

BWR Control Rod Mechanical Design Considerations Based on a Review of General Electric Control Rod Design and Performance History
Scott Nelson ..... pg. 40
GE Hitachi Nuclear Energy, Wilmington, NC

Effect of Energy Group Structure on a Stylized European Pressurized Reactor (EPR) For Criticality Analysis
Daniel Lago and Farzad Rahnema ..... pg. 58
Nuclear & Radiological Engineering/Medical Physics Programs, Georgia Institute of Technology, Atlanta, GA, USA

Innovative Core Loading, Reload Design, and Licensing

7 Experience Developing Power Peaking Penalties for Fuel Assemblies Reconstituted with Stainless Steel Rods at Oconee Nuclear Station
David Orr and Joy Forster ..... pg. 71
Duke, Charlotte, NC

8 Innovative Approach to Reloading an Initial Cycle
Jun Shi, Samuel Levine, and Kostadin Ivanov ..... pg. 83
The Pennsylvania State University (PSU), University Park, PA

14 On Multiobjective Optimisation Approaches for In-Core Fuel Management Optimisation
Evert B. Schlünz (1, 2), Pavel M. Bokov (1), Jan H. van Vuuren (3) ..... pg. 94
1) Radiation and Reactor Theory, Necsa, Pretoria, South Africa, 2) Department of Logistics, Stellenbosch University, Matieland, South Africa, 3) Department of Industrial Engineering, Stellenbosch University, Matieland, South Africa

17 The Greedy Exhaustive Dual Binary Swap Method for Fuel Loading Optimization Using the Poropy Reactor Optimization Tool
Carl C. Haugen and Kord S. Smith ..... pg. 105
Massachusetts Institute of Technology, Cambridge, MA

Error Quantification of Core Simulation Capabilities, Core Follow Data to Enhance Core Simulation Fidelity, Utilization of Zero Power Physics Tests

83 Tutorial Series on Characterization of Uncertainty (TUSC): Reduced Order Modeling, Dimensionality Reduction, Surrogate Modeling, Function Approximation, Fitting, etc.
Hany S. Abdel-Khalik ..... pg. 122
School of Nuclear Engineering, Purdue University, West Lafayette, IN

87 Identifying Modeling Parameters to Influence an Operating Experience Observation
Atul A. Karve and Russell E. Stachowski ..... pg. 130
Global Nuclear Fuel, Wilmington, NC
74 Evaluation of the NPP Krško Core by JSI and Westinghouse Nuclear Analysis Codes
Marjan Kromar (1), Fausto Franceschini (2), Dušan Ćalić (1), Harish C. Huria (2) ..... pg. 151
1) Jožef Stefan Institute, Reactor Physics Division, Ljubljana, Slovenia, 2) Westinghouse Electric Company LLC, Cranberry Township, PA

Modeling Methods, Advances in Reactor Stability and Fuel Temperature Feedback for Steady-State and Transients

10 Modeling Methods for Tightly Packed Granular Fuel
Abdalla Abou-Jaoude and Anna Erickson ..... pg. 162
Nuclear and Radiological Engineering Program, Georgia Institute of Technology

Advanced or Extended Fuel Cycles and Economic analysis

18 Updated Fuel Cycle Cost Model of the Fluoride-salt-cooled High Temperature Reactor (FHR) Based on Neutronic Calculations Using MC Dancoff Factors
Christopher Kingsbury and Bojan Petrovic ..... pg. 195
Georgia Institute of Technology, Nuclear and Radiological Engineering, Atlanta, GA

57 24-month PWR Fuel Cycles - Two Decades of AREVA Design and Operating Experience
Craig Hove ..... pg. 215
AREVA Inc., Lynchburg, Virginia, USA

Economic Assessment of Accident Tolerant Fuel Cladding Options
Nathan Andrews, Koroush Shirvan, Ed Pilat, Mujid S. Kazimi ..... pg. 224
Massachusetts Institute of Technology, Cambridge MA

80 Nuclear Fuel Management Capacity Building Initiative for the Perspective of Introducing Nuclear Power in Morocco
Bouhelal Oum Keltoum ..... pg. 235
Higher National School of Mines of Rabat ENSMR Organization, Dept Industry Process, Rabat, Morocco

Core Analysis Tools for Fuel Management: Modeling and Validation - Part 1

58 AP1000® PWR Startup Core Modeling and Simulation with VERA-CS
1) Westinghouse Electric Co. LLC, Cranberry Township, PA, USA, 2) Oak Ridge National Laboratory, Oak Ridge, TN, 3) University of Michigan, Ann Arbor

63 Two-Dimensional BWR Core Analysis using Multi-Assembly CASMO5 and SIMULATE5
Rodolfo M. Ferrer, Joshua M. Hykes, Joel D. Rhodes III (1), Tamer Bahadir (2) ..... pg. 253
1) Studsvik Scandpower, Inc., Idaho Falls, ID 83404-3345, USA, 2) Studsvik Scandpower, Inc., Waltham, MA

1 Improvements in TIP and Gamma Scan Predictions in the next Generation GNF BWR Core Simulator AETNA02
James E. Banfield, Tatsuya Iwamoto, Jason Mann ..... pg. 268
GE Hitachi Nuclear Energy (GEH)/Global Nuclear Fuel (GNF)
**Modal and Lattice Physics Methods – Part 1**

45  
**Improved PWR Radial Reflector Modeling With SIMULATE5**  
Tamer Bahadir ..... pg. 279  
Studsvik Scandpower, Inc., Waltham, MA

20  
**Westinghouse Development and Customer Support for the New Core Analysis and Design System**  
Vincent S. Penkrot, William A. Boyd, Baocheng Zhang, and Kevin T. Lasswell ..... pg. 291  
Westinghouse Electric Company, Cranberry Township, Pa

21  
**Southern Nuclear’s Implementation of Westinghouse’s Next Generation Core Design Simulator and Core Monitoring Software**  
Robin D. Jones (1), Gary T. Wolfram (2) ..... pg. 303  
1) Southern Nuclear Operating Company, Birmingham, AL, 2) Westinghouse Electric Company, Rock Hill, SC

22  
**Finite Difference Method with Corrective Coupling Coefficient for Neutron Diffusion Calculation of Nuclear Reactor Core Analysis**  
Jae-Seung Song and Jin Young Cho ..... pg. 307  
Korea Atomic Energy Research Institute, Yuseong-gu, Daejeon, Korea

**Advanced Fuel Management, Multi-dimensional Burnup Analysis, and Depletion**

64  
**Methodology of the On-Line Fuel Management of Pebble Bed High Temperature Reactors Including Follow and Prediction Methods**  
Bing Xia and Fu Li, Chunlin Wei, Jian Zhang, Jiong Guo ..... pg. 316  
Institute of Nuclear and New Energy Technology, Collaborative Innovation Center of Advanced Nuclear Energy Technology, Tsinghua University, Beijing, China

25  
**Whole Core Analysis of Molten Salt Breeder Reactor**  
Jinsu Park, Yongjin Jeong, and Deokjung Lee ..... pg. 327  
Ulsan National Institute of Science and Technology, Ulsan, Republic of Korea

49  
**Design of a Fast Breed/Burn Reactor Core Using the Deterministic Code KANEXT**  
Roberto Lopez-Solis and Juan Luis Francois-Lacouture ..... pg. 339  
Universidad Nacional Autónoma de México, Facultad de Ingeniería, Morelos, Mexico

**Core Analysis Tools for Fuel Management: Modeling and Validation – Part 2**

15  
**Optimizing the In-Core Fuel Management of BWRs using Rosa** ..... pg. 350  
L. Gilli and P H Wakker  
NRC Utrechtseweg 310, Arnhem, The Netherlands

69  
**Pellet-Cladding Mechanical Interaction Analyses Using VERA**  
Electric Power Research Institute, Palo Alto, CA

85  
**Physics-guided Coverage Mapping (PCM): A New Methodology for Model Validation**  
Hany S. Abdel-Khalik (1) and Ayman I. Hawari (2) ..... pg. 377  
1) School of Nuclear Engineering, Purdue University, West Lafayette, IN, 2) Department of Nuclear Engineering, North Carolina State University, Raleigh, NC

23  
**A Method to Optimize Robust Core Design Performance Based on Design for Six Sigma (DFSS) Methodology**  
Serkan Yilmaz ..... pg. 389  
Global Nuclear Fuel – Americas, Wilmington, NC

24  
**Optimizing the Outage Refueling Time with Shuffle Conscious Core Design Evaluation via ePROMETHEUS™**  
Serkan Yilmaz (1), John A. Elam (contributor) (2) ..... pg. 402  
1) Global Nuclear Fuel – Americas, Wilmington, NC, 2) Nuclear Engineering Consultant, Leland, NC
Comparative Neutronics Analysis of DIMPLE S06 Benchmark
Wonkyeong Kim, Jinsu Park, Deokjung Lee (1), Tomasz Kozlowski (2) ..... pg. 416
1) Ulsan National Institute of Science and Technology- UNIST, Ulsan, Republic of Korea, 2) University of Illinois, Urbana-Champaign, USA

CASMO5 Analysis of NCA Tungsten Critical Experiments
Joshua Hykes and Rodolfo Ferrer ..... pg. 432
Studsvik Scandpower, Inc., Idaho Falls, ID

Automated Reactor Records Evaluation Framework
Jonatan Hejzlar and Frantisek Havlíuj ..... pg. 441
Reactor Physics Department, UJV Rez, s.r.o.

CRANE: A New Scale Super-Sequence for Neutron Transport Calculations
Congjian Wang and Hany S. Abdel-Khalik (1), Ugur Mertyurek (2) ..... pg. 452
1) School of Nuclear Engineering, Purdue University, West Lafayette, IN, 2) Oak Ridge National Laboratory, Oak Ridge, TN

Performance of Thoria Fuels and SiC Cladding for Burning of Plutonium in Pressurized Water Reactors
Yanin Sukjai and Mujid S. Kazimi ..... pg. 483
Massachusetts Institute of Technology, Cambridge, MA

The TRU-Incinerating Thorium RBWR Core Preliminary Design
Phillip Gorman, Sandra Bogetic, Guanheng Zhang, Massimiliano Fratoni, Jasmina Vujic, and Ehud Greenspan ..... pg. 483
University of Berkeley, California

Automated and Interactive Fuel Management Design and Optimization Tools - Part 1
F.C.M. Verhagen, H.P.M. Gibcus, P.H. Wakker (1), D. Janin, M. Seidl (2) ..... pg. 509
1) NRG, Arnhem, The Netherlands, 2) E.ON Kernkraft GmbH, Hannover, Germany

Designing Optimized Shuffles with SOSA
P.H. Wakker, H.P.M. Gibcus and F.C.M. Verhagen ..... pg. 533
NRG, Arnhem, The Netherlands

A New MIP Based Loading Pattern Search Tool
Frank Popa ..... pg. 541
Westinghouse Electric Company LLC, Cranberry Township, PA

Advanced Fuel Assembly and Burnable Absorber Designs
Ian Younker (1), Massimiliano Fratoni (2) ..... pg. 551
1) The Pennsylvania State University, University Park, PA, 2) University of California, Berkeley, CA
59 A Full Core Integral Fuel Performance Assessment of SiC Cladding
Alexander J. Mieloszyk, Ronald Gil, Korosh Shirvan, Mujid S. Kazimi ..... pg. 564
Massachusetts Institute of Technology, Center for Advanced Nuclear Energy Systems, Cambridge, MA

53 Accident Tolerant Fuel and Resulting Fuel Efficiency Improvements
Jeffrey Secker, Fausto Franceschini, and Sumit Ray ..... pg. 581
Westinghouse Electric Company, LLC, Cranberry Township, PA

Management, Design, and Operation Issues of Advanced Reactor Fuels, Practical Design Constraints, and Advances in On-Line Core Monitoring

70 Multiphysics PWR Modeling Including Crud Induced Power Shift (CIPS) and Crud Induced Localized Corrosion (CILC)
Andrew Petrarca, Jeffrey Secker and Michael Krammen ..... pg. 591
Westinghouse Electric Company, Nuclear Fuel, Hopkins, SC

86 I2S-LWR Fuel Management Options for an 18-Month Cycle Length
D. Salazar, F. Franceschini, P. Ferroni (1), B. Petrovic (2) ..... pg. 602
1) Westinghouse Electric Company LLC, Cranberry Township, PA, USA, 2) Nuclear and Radiological Engineering, Georgia Tech, Atlanta, GA, USA

73 Overview of New MHI Online Core Monitoring System VISION
Yuki Takemoto, Kazuki Kirimura, Naoko Iida, Shinya Kosaka, Hideki Matsumoto ..... pg. 613
Nuclear Energy System Division, Mitsubishi Heavy Industries, Ltd., Hyogo-ku, Kobe, Hyogo, Japan

77 SMR Fuel Cycle Optimization and Control Rod Depletion Using Nestle and LWROPT
Keith E. Ottinger, P. Eric Collins, Nicholas P. Luciano, and G. Ivan Maldonado ..... pg. 623
The University of Tennessee, Department of Nuclear Engineering, Pasqua Engineering Building, Knoxville, TN

88 Deterministic Methods for PWR Fuel Loading Optimization
Fariz Abdul Rahman and John C. Lee (1), Fausto Franceschini (2) ..... pg. 637
1) University of Michigan, Ann Arbor, 2) Westinghouse Electric Company LLC, Cranberry Township, PA, USA