Proceedings of 2024 31st International Conference on Nuclear Engineering

(ICONE31)

Volume 10

August 4-8, 2024 Prague, Czech Republic

Conference Sponsor
Nuclear Engineering
Division

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

© 2024, The American Society of Mechanical Engineers, 150 Clove Road, Little Falls, NJ 07424, USA (www.asme.org)

All rights reserved. "ASME" and the above ASME symbols are registered trademarks of the American Society of Mechanical Engineers. No part of this document may be copied, modified, distributed, published, displayed, or otherwise reproduced in any form or by any means, electronic, digital, or mechanical, now known or hereafter invented, without the express written permission of ASME. No works derived from this document or any content therein may be created without the express written permission of ASME. Using this document or any content therein to train, create, or improve any artificial intelligence and/or machine learning platform, system, application, model, or algorithm is strictly prohibited.

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FROM SOURCES BELIEVED TO BE RELIABLE. HOWEVER, NEITHER ASME NOR ITS AUTHORS OR EDITORS GUARANTEE THE ACCURACY OR COMPLETENESS OF ANY INFORMATION PUBLISHED IN THIS WORK. NEITHER ASME NOR ITS AUTHORS AND EDITORS SHALL BE RESPONSIBLE FOR ANY ERRORS, OMISSIONS, OR DAMAGES ARISING OUT OF THE USE OF THIS INFORMATION. THE WORK IS PUBLISHED WITH THE UNDERSTANDING THAT ASME AND ITS AUTHORS AND EDITORS ARE SUPPLYING INFORMATION BUT ARE NOT ATTEMPTING TO RENDER ENGINEERING OR OTHER PROFESSIONAL SERVICES. IF SUCH ENGINEERING OR PROFESSIONAL SERVICES ARE REQUIRED, THE ASSISTANCE OF AN APPROPRIATE PROFESSIONAL SHOULD BE SOUGHT.

ASME shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B7.1.3). Statement from the Bylaws.

For authorization to photocopy material for internal or personal use under those circumstances not falling within the fair use provisions of the Copyright Act, contact the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, tel:978-750-8400, www.copyright.com.

Requests for special permission or bulk reproduction should be addressed to the ASME Publishing Department, or submitted online at: https://www.asme.org/publications-submissions/journals/information-for-authors/journalguidelines/rights-and-permissions

ISBN: 978-0-7918-8830-8

## TABLE OF CONTENTS

| Geometric Uncertainty Analysis of Fuel Assembly Based on Sub-Channel Model  | I  |
|---|----|
| A Study of Safety Importance Screening Criteria in the NPP Risk-Informed Safety Classification Process  | 10 |
| Jinghua Zhou, Wei Deng, Chao Ma, Yiwen Guo  |    |
| Comparative Study of Deep Learning Models for Accidents Classification in NPP: Emphasizing Transparency and Performance                                       | 19 |
| A Text Intelligence-Based Approach for Automatic Generation of Fault Trees in Nuclear Power Plants  | 25 |
| Xingyu Xiao, Songlin Liu, Zhiyong Zuo, Peng Chen, Ben Qi, Jingang Liang, Jiejuan Tong   |    |
| The Development of the Fire PRA Model for Shimane Unit 2 Nuclear Power Plant  | 35 |
| Enhancement of Shimane Unit 2 Internal Event At-Power PRA for Reflecting New Findings Including Current Plant States  | 47 |
| Takahiro Usui, Hiroki Nakamura, Kenichi Ihara, Yuki Hirai, Hitoshi Nojima, Satoshi Yoneda,<br>Kenichi Kanda, Kazunobu Noriyasu, Daichi Shiota, Naoki Hirokawa |    |
| Analysis of Mobile Equipment Configuration for Severe Accidents in Nuclear Power Plants Based on Multi-Unit PSA   | 55 |
| Dalin Liu, Jiangguo Wang, Zhen Yan, Shuting Wang, Ling Zhao   |    |
| Typical Fault Diagnosis Model of Nuclear Power Plant Combined With Knowledge Driven and Data Driven   | 61 |
| Xin Wang, Minjun Peng, Hang Wang, Zikang Li   |    |
| Impact of Synoptic Weather Patterns Along the Pacific Coastline of Japan on Tornado Wind Hazard Curves  | 67 |
| Kota Fujiwara, Daisuke Nohara, Yuzuru Eguchi, Yasuo Hattori, Hiromaru Hirakuchi   |    |
| Effect of Hydrogen Plant Structure on Hydrogen Diffusion  | 75 |
| Typical Sequence Analysis of SLOCA Accidents in a Third Generation Nuclear Power Plant Based on RISMC Method  | 80 |
| Churan Feng, Jingxiang Zhan, Lin Yan, Yiming Wang, Jinghua Zhou   |    |
| Human Reliability Analysis for a Passive NPP and Application in Plant Operating Procedure Optimization  | 86 |
| Yongping Qiu, Xiao Tan  |    |
| Quantifying Software Safety in Nuclear Power Plants: A Framework for Requirements Phase  Assessment   | 90 |
| Boyuan Li, Duo Li, Jianghai Li, Chao Guo, Huasheng Xiong, Shuajao Zhou, Xiaojin Huang   |    |

| The Mission Time Analysis in Level 2 Probabilistic Safety Assessment of the Third-Generation  Nuclear Power Plant                           | 100 |
|---|-----|
| Shujie Guo, Jing Liu, Yubao Zhong   |     |
| Effect of Different Temperature Probability Curve Fitting Methods on the System Reliability for PCCS in AP1000                              | 104 |
| Yu Yu, Guanyu Liu, Wanxin Feng, Houjian Zhao, Xuefeng Lyu   |     |
| Risk-Informed Defense-in-Depth Strategy for Nuclear Power Plant   | 108 |
| Design Management Platform Maturity Research and Improvement Application  | 115 |
| Study on the PSA Application in Emergency Operating Procedure Development   | 121 |
| Safety Evaluation and Optimization of Nuclear Power Plant Under Adaptive Sampling   | 126 |
| Research on the Application of Risk-Managed Technical Specifications in Passive Nuclear Power Plants  | 137 |
| Zhen Yan, Jiajian Wang, Gang Ma, Jianwen Sun, Zhenqi Wang, Dalin Liu, Shuting Wang,<br>Sheng Zhu  |     |
| Modeling and Analysis of VENUS-2 MOX Core Experiment Based on OpenMC Monte Carlo Code   | 142 |
| Zelong Zhao   |     |
| Research and Preliminary Verification of the Resonance Self-Shielding Calculation Method for the High-Fidelity Neutronics Code VITAS        | 147 |
| The General Quadrant Meshing Approach for Constructive Solid Geometry Based Method of Characteristics                                       | 153 |
| Jian Guo, Guifeng Zhu, Rui Yan, Yang Zou  |     |
| Modeling Co-Current and Counter-Current Flow: A Performance Evaluation of the TRACE Condensation Model with Non-Condensable and Light Gases |     |
| Samah A. Albdour, Yacine Addad, Imran Afgan   |     |
| Validation and Verification of ASYST Code for Predicting Condensation Phenomena in Nuclear Reactor Safety Systems                           | 169 |
| Satya Prakash Saraswat, Mubashir Hassan, Sameer Mohammad Osman, Chris Allison,<br>Yacine Addad  |     |
| Tube Plugging Induced Temperature Non-Uniformity in Once Through Steam Generator  | 177 |
| Verification and Analysis of Thermal-Hydraulics System Program for a Power Plant Model  | 183 |
| Comparative Analysis of Loss of Coolant Accidents for GEN-III PWRs Based on ACME and ATLAS Facilities                                       | 193 |
| Yuhang Huang, Xueyan Zhang, Jun Yang  |     |

| Reducing Variance in Nuclear Monte Carlo Simulations Through Deep Learning Post-Processing Techniques in the Gaming Domain                                       | 199 |
|--|-----|
| Haoxuan Guo, Wei Li, Yaodong Sang, Haizheng Chen, Qingmin Zhang  |     |
| Code-to-Code Verification of Thermal Hydraulic Subchannel Code LINDEN  | 205 |
| Multi-Physics Coupling Simulation of a Small Floating Lead-Cooled Fast Reactor Based on OpenMC and GeN-Foam  | 213 |
| Haochen Huang, Fei Xie, Yu Liu, Daogang Lu   |     |
| TRIPOLI-4(R) Monte Carlo Code Verification and Validation Using T4G Tool   | 221 |
| Verification of the RMC-SaraGR Nuclear Design Code System Based on the HTTR Benchmark  | 231 |
| OECD-NEA Expert Group on Reactor Systems Multi-Physics: Development of Verification and Validation Guidelines for Multi-Physics Simulations                      | 236 |
| Timothy E. Valentine, Evgeny Ivanov, Kostadin Ivanov, Alessandro Petruzzi, Maria Avramova,<br>Mathieu Hursin, Oliver Buss  |     |
| SIMMER-III Code Simulation of High-Pressure Water-Lead Interaction in Westinghouse's LEWIN Test Facility   | 242 |
| Alessandro Bellomo, Mattia Massone, Simone Gianfelici, Fabio Martini, Sung Jin Lee,<br>Mariano Tarantino, Francesco Galleni, Andrea Pucciarelli, Alessio Pesetti |     |
| Pure Lead Thermodynamic Properties in SIMMER-III Code: A Comparative Review and New Evaluation Proposal  | 249 |
| Alessandro Bellomo, Mattia Massone, Simone Gianfelici, Koji Morita, Mariano Tarantino,<br>Alessio Pesetti, Vittorio Cossu, Andrei Rineiski                       |     |
| Development and Verification of a Few-Group Parameters Calculation Code TMSR-LINK for Molten Salt Reactor  | 257 |
| Kailong Wang, Yong Cui, Chunyan Zou, Jingen Chen, Xiangzhou Cai  |     |
| Development of a Spatial Dynamics Model Based on Semi-Analytic Nodal Method  | 267 |
| Study on Development Pathways of Nuclear Energy for Energy System in China Using Message  Model  | 277 |
| Luhan Mei, Xiaotong Chen, Huang Zhang  |     |
| Researchers Understanding of the Possible Contribution of International Atomic Energy's to the Launch of a National Nuclear Power Programme                      | 283 |

## **Author Index**