7-8 November 2024 • Manchester

Nuclear Institute

NUCLEAR MODELLING 2024

7th Annual Modelling in Nuclear Science and Engineering Seminar

PROGRAMME

Scan for Agenda and Abstracts

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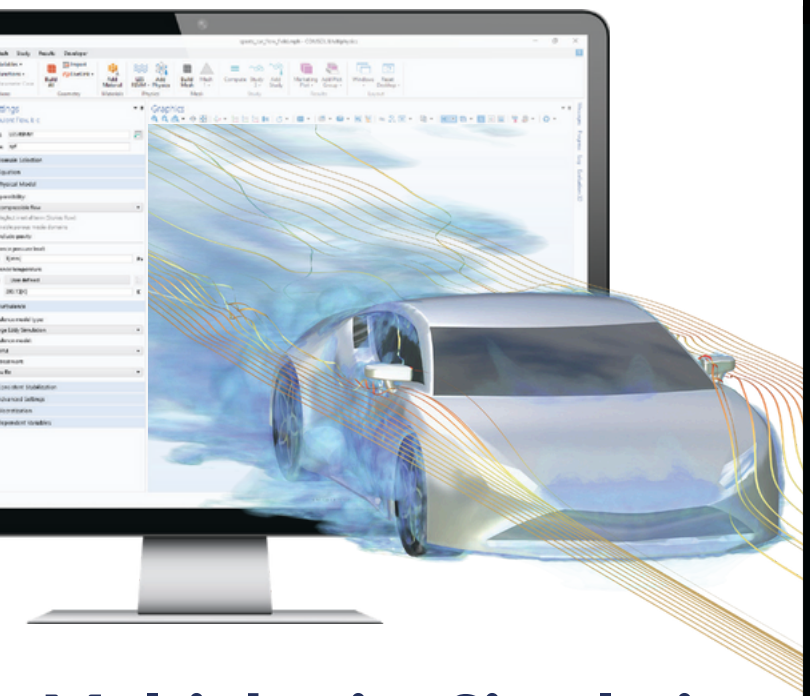

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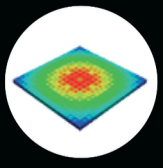

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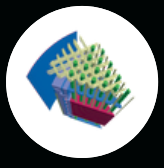

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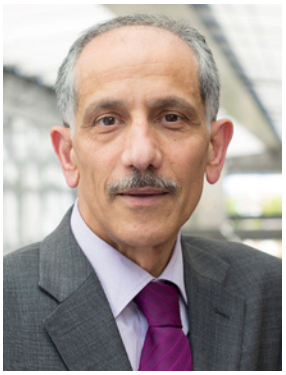
WELCOME



The 7th Modelling in Nuclear Science and Engineering Conference aims to bring together the community to share modelling techniques to help improve design and operation of nuclear energy generation, processing and storage facilities including power plants to protect society by improving safety of these facilities.

The goal of scientific modelling as an activity is to make features and performance of the design easier to understand, quantify, visualise, or simulate by adopting rigorous scientific methods. This Conference will provide a platform to highlight exciting new modelling methods and applications. Previous attendees at this conference included a broad range of industry members, leading academics and those at an early career stage.

The Conference is developed to offer a fantastic line-up of speakers and a fascinating set of topics and themes to offer scientists and engineers a view on future developments, which will include exploring how AI can be adopted to support modelling in the nuclear industry.

Professor Ali Tehrani, CEng, FNucI, FIMechE

Conference Organising Committee Chair

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DAY 1 THURSDAY 7 NOVEMBER

08:30 – 09:00	REGISTRATION, NETWORKING and REFRESHMENTS
09:00 – 09:30	OPENING and WELCOME Prof. Ali Tehrani FNucI, Conference Chair Dr Fiona Rayment OBE FNucI, President of the Nuclear Institute
SESSION 1: Impact of Modelling in Nuclear Engineering and Science Chair: Prof. Ali Tehrani FNucI	
09:30 – 10:00	**Keynote Speaker** **Fostering artificial intelligence applications in nuclear science and engineering** Dr Oliver Buss OECD Nuclear Energy Agency
10:00 – 10:20	**Underpinning the Decommissioning Strategy for the most Hazardous Nuclear Storage Facility in Western Europe** Joshua Byrne and Mike Ellarby Sellafield Ltd & ITI Group
10:20 – 10:40	**Using AI to Model Systems in Nuclear Science and Engineering** Christopher Pain, Ali Tehrani, David Luxat, Sadjad Naderi, Boyang Chen, Claire E Heaney and Paul Smith Imperial College London
10:40 – 11:00	**Chat-Based Assistant for Training and Education of Nuclear Engineers** Anna Detkina and Lewis Powell University of Liverpool
11:00 – 11:20	BREAK
SESSION 2: Multi-physics and Multi-scale Modelling Chair: Prof. Paul Smith	
11:20 – 11:40	**Overview of Multi-Physics and Multi-Scale Simulation Capabilities at GRS** Yann Périn GRS
11:40 – 12:00	**Heterogeneous dilution transient in a PWR nuclear power plant using multi-physics codes ANSYS CFX/PANTHER/COBRA3C_TE** Antony Martini, Maxime Haedens and Lucia Rueda Tractebel
12:00 – 12:20	**Large eddy simulations of conjugate heat transfer for channel flows up to a Prandtl Number of 5** Gregory Cartland-Glover and David Emerson STFC
12:20 – 12:40	**Modelling of Natural Circulation Loops using LES and unsteady RANS approaches for Nuclear Passive Cooling Applications** Dean Wilson, Hector Iacovides and Tim Craft The University of Manchester
12:40 - 13:00	**Modelling Strategies for a Boron-Free SMR Core** Mark Mawdsley and Bronwen Edge Rolls-Royce SMR
13:00 – 14:30	GROUP PHOTO, LUNCH, POSTER SESSION and NETWORKING

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DAY 1 THURSDAY 7 NOVEMBER

SESSION 3: AI, Innovation and Recent Developments in Reactor Performance and Safety Modelling Chair: Prof. Christopher Pain	
14:30 – 14:50	**Numerical Study of Axial-Flow-Induced Vibrations on Cantilevered Rods for Nuclear Reactor Applications** Wenyu Mao, Hector Iacovides and Andrea Cioncolini The University of Manchester
14:50 – 15:10	**A Non-Invasive AI Reduced Order Model for Neutron Transport** Andrew Buchan Queen Mary University
15:10 – 15:30	**Simulation Modelling for Optimised Effluent Waste Management** Conor Chalcroft, Nick Barton, Jack Lewis and Janette Mchendry Ada Mode
15:30 – 15:50	**The use of AI to produce data-driven algorithms for critical heat flux** Simon Cox, Kajetan Streciwilk and Paul Smith Amentum
15:50 - 16:10	BREAK
SESSION 4: Chemical and Fuel Cycle Facilities Chair: Dr Andrew Buchan	
16:10 – 16:30	**Discrete Event Simulation for the Optimisation of Fuel Handling and Station Operations at AGR Stations** Morgan Rogers and Andrew Coles AtkinsRéalis, EDF
16:30 – 16:50	**Implications of Keyway Cracking on the Onset of Induced Crack in Advanced Gas-Cooled Reactor** Ahmadreza Farrokhnia, Graham Hall and Abbie Jons The University of Manchester UK Export Controlled
16:50 – 17:10	**Ensuring Safe Containment of Special Nuclear Material Through Advanced Computational Modelling** Robert English, Tim Ashworth, Saffron Wyse and Pawel Woelke Thornton Tomasetti
17:10 – 17:30	**Atomistic simulations of point defect models in uranium nitride (UN) and plutonium nitride (PuN)** William Watson, Matthew Horton, Sophie Cooper, William Neilson, Conor Galvin and Robin Grimes Imperial College London, National Nuclear Laboratory
17:30	DAY 1 CLOSES
19:30 – 22:00	CONFERENCE DINNER - voco Hotel Manchester

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DAY 2 FRIDAY 8 NOVEMBER

07:45 – 08:20	COFFEE and NETWORKING
SESSION 5: Plant Performance in Accident Conditions Chair: Prof. Panagiota Angeli	
08:20 – 08:50	Keynote Speaker **High-Fidelity Multi-Physics Simulation Platform JAMPAN** Dr Kenichi TADA Japan Atomic Energy Agency
08:50 – 09:10	**3D visualization of gamma radiation field distribution for radiological protection during NPP decommissioning** Mikołaj Oettingen AGH University of Krakow
09:10 – 09:30	**Atmospheric Dispersion Modelling for Informed Decision Making in Modern Nuclear Safety Cases** Dr Russell Mills, Robert Gordon, Melissa Cutler, Howard Chapman and Stephen Lawton Risk Aware
09:30 – 09:50	**Designing a molten salt experimental device for the Jules Horowitz Reactor** Patrick Carter-Cortez and Geoff Parks University of Cambridge
09:50 - 10:10	**Application of Fuel Performance Modelling on Operational Civil Nuclear Reactors at EDF Energy** Oliver Perry and Adam Askam EDF Energy
10:10 – 10:30	BREAK
SESSION 6: Reactor Thermal Hydraulics, Fuel Performance, Neutronics, Criticality and Shielding Chair: Dr Amir Nourian	
10:30 – 10:50	**Image Reconstruction of Gamma Source Data using a Simulated Compton Camera and the Stochastic Origin Ensemble Method** Jessica Fildes and Dennis Allen Amentum
10:50 – 11:10	**Development of a Multiphysics Fuel Performance Modelling Capability** Brendan Tollit, William Poole, Henry Smith, Peter Smith and Paul Smith Amentum
11:10 – 11:30	**Advanced Development and Optimization of HPC Numerical Simulation Tools for Nuclear Thermal Hydraulics** Wei Wang, Bo Liu, Greg Cartland-Glover, Charles Moulinec and Stefano Rolfo STFC
11:30 – 11:50	**Computational Fluid Dynamics Modelling of Thermal Treatment Applications** Ella Schaefer, Sarah Swales, Saffron Wyse, Robert English, Tim Ashworth and Euan Williamson Thornton Tomasetti
11:50 – 12:10	**Phase-field modelling of fission gas-bubble formation in nuclear fuels** MD Zahid Hasan Bangor University

DAY 2 FRIDAY 8 NOVEMBER

12:10 – 13:20	LUNCH, POSTER SESSION, and NETWORKING
SESSION 7: Optimisation Techniques to Support Design and Process Developments Chair: Dr Oliver Buss	
13:20 – 13:40	**Gaussian Process based optimisation of plate-type fuel assemblies** Henry Bennett and Geoff Parks University of Cambridge
13:40 – 14:00	**Back to Basics: Practical Modelling for Nuclear Chemical Plant** David Leng DBD International
14:00 – 14:20	**Application of Particle Swarm Optimisation in the design process of a boron free small modular reactor core** Madinka Bright Mweetwa Bangor University
14:20 – 14:40	**Preliminary reactor physics analysis for the UKJ-HTR** Anna Detkina, Dzianis Litskevich, Mark Bankhead and Matthew Horton University of Liverpool, National Nuclear Laboratory
14:40 – 14:50	BREAK
SESSION 8: Energy Systems and Experimental Techniques in Supporting Modelling Activities Chair: Prof. Ali Tehrani FNucI	
14:50 – 15:10	**Safety Assessment of the Spherical Tokamak for Energy Production (STEP) Using MELCOR: Modelling Loss-of-Coolant Accidents and System Responses** Samad Khani and Matthew Lukacs UKAEA
15:10 – 15:30	**Direct Conversion Thermoelectric Reactors for Powering Future Space Exploration** Oliver Jeffery, Agostino Maurotto, Pietro Alessandro Di Maio, Pierluigi Chiovaro and Ramy Mesalam University of Leicester
15:30 – 15:40	CLOSING REMARKS and FEEDBACK

POSTERS

Poster 1	**Use of AI Libraries to Solve the Discretized Neutron Diffusion Equation** Kajetan Streciwilk, Brendan Tollit, Paul Smith, Boyang Chen, Christopher Pain Amentum, Imperial College London
Poster 2	**Evaluation of natural radioactivity level in Delanta-Dawunt, Wollo District, Ethiopia** Mekuanint Lemlem Legasu Adama Science and Technology University
Poster 3	**Application of Process Chemical Modelling to Support Savannah River's Liquid Waste Programme** Effran Rafael, Andreas Georgiou, Scott Williamson-Owens DBD International
Poster 4	**Modelling dispersion of aqueous effluent from Heysham 1 and 2 power stations to understand the environmental performance of existing and alternative discharge arrangements during decommissioning** Rosie Newton, Ian Godfrey, Rebecca Butler, Tim Soetens Eden Nuclear & Environment
Poster 5	**Recent Developments in the LOTUS Neutron Transport Code for Reactor Simulations** Dzianis Litskevich, Anna Detkina University of Liverpool
Poster 6	**Application of URANS Simulation of Axial Flow-Induced Vibrations on a Blunt-End Cantilever Rod for Nuclear Applications** Anas Muhamad Pauzi, Hector Iacovides, Andrea Cioncolini The University of Manchester
Poster 7	**Calculation of lead activation in LFR using OpenMC** Simone Maggi, Matteo Zammataro, Daniele Tomatis Newcleo
Poster 8	**Agglomeration, dissolution, and fragmentation behaviour of simulated nuclear fuel debris nanoparticles via kinetic Monte Carlo simulations** Miguel Pineda, Cong Chao, Yiwei Zhang, Takehiko Tsukahara, Panagiota Angeli, Eric S. Fraga University College London, Laboratory for Zero-Carbon Energy, Tokyo
Poster 9	**Concrete Defect Detection and Analysis using AI Software** Tim Ashworth Thornton Tomasetti

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