


# Prashant K. Jain

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- Citations: <https://scholar.google.com/citations?user=nvr-hUUAAAAJ>

## Profile

Dr. Prashant Jain is the interim Section Head for the Advanced Reactor Engineering and Development Section in the Nuclear Energy & Fuel Cycle Division at Oak Ridge National Laboratory (ORNL). He earned his MS (2006) and PhD (2010) in nuclear engineering from the University of Illinois, Urbana-Champaign, and his BTech (2004) in mechanical engineering from the Indian Institute of Technology, Bombay. With over 20 years of experience, Dr. Jain specializes in advanced multi-physics modeling, applications of machine learning and artificial intelligence for nuclear digital twins, nuclear thermal design and safety analyses, computational fluid dynamics (CFD), single- and two-phase turbulent flows and heat transfer, analytical benchmarks, the lattice Boltzmann method, and parallel scientific software development.

Dr. Jain is a permanent member of the Advisory Board of the Nuclear Engineering and Radiological Sciences at the University of Michigan (NERS). Additionally, he is part of the program committee for the COMSOL Conference 2024 in Boston, USA, and served on the organizing committees for the 31st International Conference on Nuclear Engineering in Prague, Czech Republic, in August 2024, and the 1st Atoms for Humanity Symposium at Purdue University in October 2023. As a thought leader in his field, Dr. Jain contributes to various academic journals. He is a guest editor for the Nuclear Engineering and Design Journal's Special Issue on Outcomes and Achievements from Researchers Orienting the Future of Nuclear Fission Technology, an associate editor for the Frontiers in Energy Research (Nuclear Energy) Special Issue on Shaping the Future of Nuclear Assets with Digital Twins, and an associate editor for the Applied Sciences' Special Issue on CFD Analysis for Nuclear Engineering.

At ORNL, he leads the development of advanced three-dimensional multi-physics design and safety basis models for the current highly enriched uranium core and the proposed low-enriched uranium core designs of the High Flux Isotope Reactor (HFIR). Previously, he served in leadership roles as Group Leader and Team Lead for Thermal Hydraulics R&D in the Division. Throughout his career, Dr. Jain has led numerous research projects as a principal investigator or co-investigator. Notably, he has been instrumental in assessing Digital Twin technology for nuclear systems in support of the US Nuclear Regulatory Commission. Moreover, Dr. Jain was the principal developer of ORNL's lattice Boltzmann method CFD code, PRATHAM, and the thermo-fluidics thrust lead for the Transformational Challenge Reactor (TCR) project. He has led multiple industry CRADAs with Eaton Corporation, Gopher Resource, Alcoa USA, Linde Corporation, and Spar Energy for the DOE's High-Performance Computing for Energy Innovation Program.

Dr. Jain is a recipient of the American Nuclear Society (ANS) Mark Mills Award for his doctoral research on lattice Boltzmann methods and UT-Battelle's 2019 Mission Support Award for his contributions to the HFIR event causal analysis.

## Education

- **Ph.D. in Nuclear Engineering,** 2006 – 2010  
University of Illinois, Urbana-Champaign
- **M.S. in Nuclear Engineering,** 2004 – 2006  
University of Illinois, Urbana-Champaign
- **Bachelor of Technology in Mechanical Engineering,** 2000 – 2004  
Indian Institute of Technology, Bombay, INDIA

## Work Experience

**Interim Section Head** 2022 – present  
*Advanced Reactor Engineering & Development*

*Nuclear Energy & Fuel Cycle Division, ORNL*

- Responsible for providing line management and technical leadership for 60+ research and technical staff in the Advanced Reactor Engineering & Development Section at ORNL to pursue scientific and technical innovations that are aimed towards:
  - Improving construction, operation, maintenance, and integration of nuclear energy with other sources
  - De-risking advanced reactors through innovative designs, simulations, and prototype demonstrations
  - Enhancing nuclear safety, security, and performance of nuclear facilities and applications
  - Advancing risk-informed decision-making, compliance, and capacity building for nuclear energy
  - Strengthening digital twins for fission, fusion & other energy systems through I&C, data, and models.

**Group Leader**

2020 – 2022

*Thermal-Hydraulics Group**Nuclear Energy & Fuel Cycle Division, ORNL*

- Responsible for new business growth and program development efforts to sustain a group of 13 research professionals and advance the group through securing an R&D funding of \$4 million per annum.
- Served as an immediate supervisor for staff members in the Thermal Hydraulics group. Encouraged staff to “think and dream big,” take appropriate risks in their work, and develop skills that enable them to pursue new ideas, scientific passions, and research programs.
- Supported group members by consistently reviewing technical products such as proposals, publications, and artifacts to ensure high quality and consistency with ORNL standards.
- Integrated program development activities with other line and program managers and collaborated to assemble the best available teams and technical resources for each project.
- Thermofluidic Thrust Lead– Transformational Challenge Reactor (TCR) Project.
- Multiphysics CFD Lead– HFIR LEU Conversion Program.
- Principal Investigator– HPC4Manufacturing Projects, Digital Twin Assessment for the Nuclear Regulatory Commission.
- Contributor– ARPA-E INTEGRATE, SNS Proton Power Upgrade, SNS Second Target Station Projects.

**Thermal-Hydraulics Team Lead**

2018 – 2020

*Advanced Reactor Engineering Group**Reactor and Nuclear Systems Division, ORNL*

- Established multi-physics research capabilities for nuclear applications to benefit from advancement in high-performance computing technologies. Led and supervised a team of staff scientists, engineers, and postdoctoral candidates to advance research in CFD and nuclear systems safety analysis. Successfully expanded existing research efforts and assisted the group leader in recruiting a high-quality, diverse pool of qualified candidates for the team.

**Nuclear Computational Fluid Dynamics Engineer**

2012 – 2018

*Thermal Hydraulics and Irradiation Engineering Group**Reactor and Nuclear Systems Division, ORNL*

- Led the development of advanced multi-physics modeling and simulation capabilities for the HFIR low-enriched uranium conversion project under the DOE National Nuclear Security Administration Office of Material Management and Minimization.
- Served as an independent safety reviewer for the Plutonium-238 production program sponsored by the National Aeronautics and Space Administration.
- Responsible for performing independent safety reviews for the low-flow qualification of HFIR beam tubes and numerous other material irradiation tests and experiments using advanced CFD simulations.
- Supported proposal and program development activities for the ORNL seed money and laboratory-directed R&D programs, nuclear energy advanced modeling and simulation program, nuclear regulatory commission, advanced manufacturing office, nuclear energy university program, nuclear safety research and development program, and high-performance computing for manufacturing program.

- Supported the development of a high-temperature capable centrifugal pump technology for molten salt reactors through advanced CFD simulations.

### Postdoctoral Research Associate

2010 – 2012

*Thermal Hydraulics and Irradiation Engineering Group  
Reactor and Nuclear Systems Division, ORNL*

- Led the development of an ORNL lattice Boltzmann method code, PRATHAM, Parallel Thermal Hydraulics using Advanced Mesoscopic Methods.
- Led the development of a parallel Cartesian mesh generator code, CartGen++, for high-performance computing applications.
- Supported DOE Fukushima accident analysis efforts using exploratory hydrogen explosion simulations through time-dependent, explicit finite element methods in LS-DYNA and computational fluid dynamics simulations using COMSOL Multiphysics and STAR-CCM+.
- Developed and published infinite-series exact analytical solutions for a variety of multi-layer heat conduction problems.

### Summer Research Internships

2006 – 2009

- Idaho National Laboratory (2008, 2009)  
Supported developing an advanced utility toolkit to enable multi-variable couplings between different neutronics and thermal-hydraulics code systems.
- Argonne National Laboratory (2007)  
Guest graduate appointment to collaborate on developing an advanced multiphase lattice Boltzmann code package.
- Oak Ridge National Laboratory (2006)  
Coupled ATHENA (Advanced Thermal Hydraulic Energy Network Analyzer) code with the National Institute of Standards and Technology Reference Property Database to include cryogenic and other fluid properties.

### Graduate Research Assistant

2004 – 2010

*Nuclear Plasma and Radiological Engineering  
University of Illinois, Urbana-Champaign*

- Developed a parallel two-phase dynamics simulation toolkit using the lattice Boltzmann method to improve fundamental understanding of boiling water reactor applications.
- Developed a flow-stability analysis code to predict flow instabilities in a natural circulation loop with supercritical water and CO<sub>2</sub> fluids.

### Technical Skills

- Experienced nuclear safety professional with a specific focus on advanced multi-physics software and technology for high-fidelity modeling and simulation of nuclear systems.
- Expert in industry-leading computational fluid dynamics technologies, including COMSOL Multiphysics, STAR-CCM+, and ANSYS Workbench.
- Expert in many programming and scripting languages, including Fortran 90, C, C++, Python, Perl, and MATLAB.
- Expert in parallel programming paradigms, including Message Passing Interface – MPI, OpenMP, and knowledgeable in GPU-based code acceleration methods, CUDA, and OpenCL on leadership computing facilities.
- Experience with other engineering tools and packages, including ATHENA, RELAP5, Pro-ENGINEER, SpaceClaim, LS-DYNA, MATLAB, Mathematica, VisIt, ParaView, and Tecplot.

### Awards and Honors

- **Invited Panelist for the VaiBhaV Summit**

2020

Invited to participate in the Government of India's Vaishwik Bharatiya Vaigyanik (VaiBhaV) Summit, which was a collaborative initiative by S&T and Academic Organizations of India, to bring out the comprehensive roadmap to leverage the expertise and knowledge of global Indian researchers for solving emerging challenges.

- **UT-Battelle Mission Support Award** 2019  
For outstanding performance and dedication in determining the causes of the first fuel element failure in 52 years of HFIR operation.
- **ORNL Significant Event Award** 2012  
Nuclear Science and Engineering Directorate at ORNL conferred this award to recognize significant project accomplishments in developing Plutonium-238 production capabilities at the High Flux Isotope Reactor.
- **COMSOL Best Paper Award** 2012  
Paper on design and safety basis simulations for Pu-238 bare pellet irradiation was selected as the best paper for COMSOL's annual conference in Boston in 2012.
- **ORNL Significant Event Award** 2011  
Reactor and Nuclear Systems Division at ORNL conferred this award in recognition of significant contributions to the support of DOE in response to the nuclear crisis at Fukushima.
- **ORNL Appreciation Award** 2011  
Reactor and Nuclear Systems Division at ORNL conferred this award to recognize and appreciate my substantial role in computational analysis activities related to the ORNL's response to the events at Fukushima Daiichi.
- **American Nuclear Society – Mark Mills Award** 2010  
This is a national award given each year by the American Nuclear Society (ANS) to recognize a graduate student author who submits the best original technical paper contributing to advancing science and engineering related to the atomic nucleus.
- **Member of the Alpha Nu Sigma National Honor Society** 2006
- **Sargent and Lundy Fellowship** 2005 – 2006

## Professional Activities

- Permanent Member of the Advisory Board of the Nuclear Engineering and Radiological Sciences at the University of Michigan (NERS).
- Program Committee of the COMSOL Conference 2024, Boston, USA.
- Organizing Committee of the 31<sup>st</sup> International Conference on Nuclear Engineering, Prague, Czech Republic, Aug. 2024.
- Organizing Committee of the 1<sup>st</sup> Atoms for Humanity Symposium at Purdue University, Oct. 2023.
- Guest Editor for the Nuclear Engineering and Design Journal's Special Issue on Outcomes and Achievements from Researchers Orienting the Future of Nuclear Fission Technology.
- Associate Editor for the Frontiers in Energy Research (Nuclear Energy)' Special Issue on Shaping the Future of Nuclear Assets with Digital Twins.
- Associate Editor for the Applied Sciences' Special Issue on CFD Analysis for Nuclear Engineering.
- Member of the American Nuclear Society (ANS), since 2006.  
Thermal-Hydraulics, and Mathematics and Computations Divisions.  
Session Organizer and Session Chair for ANS annual meetings.  
Member of the Program Committee for the ANS Thermal Hydraulics Division, since 2022.
- Member of the American Society of Mechanical Engineers.
- Panelist for the National Science Foundation GRFP Program.
- Technical reviewer for:
  - International Journal of Heat and Mass Transfer
  - International Journal of Thermal Sciences
  - Nuclear Engineering and Design
  - Journal of Nuclear Technology
  - Annals of Nuclear Energy

ASME/JSME 8th Thermal Engineering Joint Conference  
 Journal of Advances in Engineering Education  
 U.S. Dept of Energy – Nuclear Energy University Program  
 U.S. Dept of Energy – Small Business Innovation Research Program  
 ORNL Innovation Crossroads Program.

## Proposals and Partnerships

- Led successful research proposals for:
  - DOE NNSA – Material Management and Minimization (M3) Program Office
  - DOE NE – NEAMS High-Impact Problem Research and NEUP Programs
  - DOE – Advanced Research Projects Agency (ARPA-E) Program
  - DOE – EERE High-Performance Computing for Manufacturing Program
  - U.S. Nuclear Regulatory Commission – Office of Nuclear Regulatory Research
  - ORNL – Seed Money Program
  - ORNL – Lab-directed Research and Development Program
  - NRC – Assessment of Digital Twins for Advanced Reactors
- Industrial partnerships with:
 

United Technologies Research Center (UTRC)	Alcoa USA
Electric Power Research Institute (EPRI)	Wenescos LLC
Gas Technology Institute (GTI)	First Solar
MetalTek International	Gopher Resource
Eaton Corporation	Praxair, Inc
HolosGen LLC	X-energy
GE Renewable Energy (Hydro)	Spar Energy
Westinghouse LLC	Linde Corporation
Atomic Canyon LLC	PG&E (Diablo Canyon)
Tokamak Energy LLC	Commonwealth Fusion Systems
Powdermet Inc	Siemens Energy
Baker Hughes	Ansys, Inc.
EarthEn	Malta, Inc.
GE Hitachi	COMSOL, Inc.
- Academic and research collaborations with:
  - Indian Institute of Technology, Bombay India
  - University of Illinois, Urbana-Champaign IL
  - Kansas State University, Manhattan KS
  - University of Michigan, Ann Arbor MI
  - University of Tennessee, Knoxville TN
  - University of Missouri, Rolla MO
  - Texas A&M University, College Station TX
  - Virginia Commonwealth University, Richmond VA
  - Argonne National Laboratory, Lemont IL
  - Idaho National Laboratory, Idaho Falls ID
  - Institut Laue–Langevin (High-Flux Reactor), Grenoble, France
  - Technical University of Munich, Research Neutron Source (FRM II), Germany
  - Pacific Northwest National Laboratory
  - Savannah River National Laboratory

## Patents and Invention Disclosures

1. H. Bindra, J. Matulis, B. Sieh, N. See, and P.K. Jain, "Reactor Core System," A Non-Provisional Patent Application, 70304-02, filed, 2024.
2. E. Lara-Curzio, C.L. Cramer, A.M. Elliott, B.A. Fricke, P.K. Jain, R.R. Lowden, K. Nawaz, V.M. Rao, and M.J. Sandlin, "Compliant Heat Exchangers, Heat Pipes and Methods for Making Same," US Patent No. US11633789B2, 2021.

## Publications: Book and Journal Articles

1. C. Bojanowski, R. Schoenecker, K. Borowiec, K. Shehu, J. Mercz, F. Thomas, A. Bergeron, P. Jain, C. Reiter, and J. Licht, "Towards Verification and Validation of Heat Transfer Modeling with CFD Codes for Involute Plate Reactors," *Nuclear Engineering and Design*, To be submitted, 2024.
2. V.M. Rao, P.K. Jain, et al., "Turbulent Gas Flows in Gyroid Topologies," *Journal of Turbulence*, Manuscript # JOT-2022-0054, To be submitted, 2024.
3. C.L. Cramer, E. Lara-Curzio, A.M. Elliott, T.G. Aguirre, B. Yoon, B. Fricke, V.M. Rao, P.K. Jain, and K. Nawaz, "Material Selection and Manufacturing for High-Temperature Heat Exchangers: Review of State-Of-The-Art Development, Opportunities and Challenges," *The International Journal of Ceramic Engineering and Science*, Submitted, 2024.
4. C. Daniel, P.K. Jain, et al., "Advanced Research Directions on AI for Energy," Report on Winter 2023 Workshops, ANL-23/69, available from: <https://www.anl.gov/ai/reference/ai-for-energy-report-2024>, 2024.
5. K. Mondal, O. Martinez, and P.K. Jain, "Advanced Manufacturing and Digital Twin Technology for Nuclear Energy," *Front. Energy Res.*, 12:1339836, 2024.
6. N.S. Panicker, G. Bazaz, V.M. Rao, S. Natesh, and P.K. Jain, "Novel designs for ejector-based systems for enhanced fluid recovery verified through CFD Simulations," *International Journal of Mechanical Engineering and Technology (IJMET)*, Volume 14, Issue 06, pp. 23-36. Article ID: IJMET\_14\_06\_004, 2023.
7. D.J. Kropaczek, V. Badalassi, P.K. Jain, P. Ramuhalli, and W.D. Pointer, "Digital Twins for Nuclear Power Plants and Facilities," in *The Digital Twin Technology, Business Models, Operations and Applications*, Springer, Springer International Publishing, 2023.
8. M. Sitek, P.K. Jain, et al., "Thermomechanical Analysis and Modeling of Involute-Shaped Fuel Plates Using the Cheverton-Kelley Experiments for the High Flux Isotope Reactor," *Nuclear Engineering and Design*, Volume 409, 112334, 2023.
9. J. Weinmeister, C. Jesse, P.K. Jain, B.J. Ade, and D. Schappel, "Coolant Channel Design for Additively Manufactured Reactor Cores," *Nuclear Science and Engineering*, 196(12), 1496–1516, 2022.
10. A. Wysocki, P.K. Jain, S. Bhatt, and J. Rader, "Analysis of Postulated Accident Scenarios for the Transformational Challenge Reactor," *Nuclear Science and Engineering*, 196(12), 1442–1463, 2022.
11. Z. Ahmed, P.K. Jain, et al., "Experimental Investigation on the Coolability of Nuclear Reactor Debris Beds Using Seawater," *International Journal of Heat & Mass Transfer*, vol. 184, p. 122347, 2022.
12. N.S. Panicker, R. Chaudhary, V.M. Rao, M.O. Delchini, and P.K. Jain, "High-Fidelity Simulation Study of the Aluminum Smelting Process Using OpenFOAM," *Metallurgical and Materials Transactions B*, vol. 53B, pp. 2407-2426, 2022.
13. V.M. Rao, Vineet Kumar, A. Anderson, J. Grogan, and P.K. Jain, "Computational Methodology to Simulate Pyrometallurgical Processes in a Secondary Lead Furnace," in *REWAS 2022: Developing Tomorrow's Technical Cycles (Volume 1)*, The Minerals, Metals & Materials Series, 2022.
14. B.J. Ade et al., "Candidate Core Designs for the Transformational Challenge Reactor," *Journal of Nuclear Engineering*, vol. 2, pp. 74-85, 2021.
15. V. Kumar, M. Harvey, M. Wendel, P.K. Jain, and N.J. Evans, "Thermal Loading Analysis of the Ring Injection Dump for the Spallation Neutron Source Facility," *Nuclear Inst. and Methods in Physics Research A*, vol. 1006, p. 165380, 2021.
16. B.R. Betzler, B.J. Ade, A.J. Wysocki, P.K. Jain, P.C. Chesser, M.S. Greenwood, and K.A. Terrani, "Transformational Challenge Reactor Preconceptual Core Design Studies," *Nuclear Engineering and Design*, vol. 367, p. 110781, 2020.
17. M. Sandlin, K. Nawaz, B. Fricke, V.M. Rao, C. Cramer, E.L. Curzio, A. Elliott, and P.K. Jain, "An Overview of the Design of High-Temperature Heat Exchangers: State of the Art Developments and Prospects," *Renewable and Sustainable Energy Reviews*, submitted in 2020.

18. D. Franken, D. Gould, P.K. Jain, and H. Bindra, "Numerical Study of Air Ingress Transition to Natural Circulation in a High-Temperature Helium Loop," *Annals of Nuclear Energy*, vol. 111, Jan. 2018.
19. C.J. Hurt, J.D. Freels, P.K. Jain, and G.I. Maldonado, "Thermo-Mechanical Safety Analyses of Preliminary Design Experiments for Pu-238 Production," *ASME Journal of Nuclear Engineering and Radiation Science*, vol. 3, no. 2, 2017 (NERS-16-1069).
20. C.J. Hurt, J.D. Freels, P.K. Jain, and G.I. Maldonado, "Thermo-Mechanical Safety Analyses for Pu-238 Production Target at the HFIR," *ASME Journal of Nuclear Engineering and Radiation Science*, vol. 3, no. 2, 2017 (NERS-16-1070).
21. S. Singh, P.K. Jain, and Rizwan-uddin, "Analytical Solution for Three-Dimensional, Unsteady Heat Conduction in a Multilayer Sphere," *Journal of Heat Transfer*, vol. 138, p. 101301, Oct. 2016.
22. D. Wang, I.C. Gauld, G.L. Yoder, L.J. Ott, G.F. Flanagan, M.W. Francis, E.L. Popov, J.J. Carbajo, P.K. Jain, J.C. Wagner, and J.C. Gehin, "Study of Fukushima Daiichi Nuclear Power Station Unit-4 Spent Fuel Pool," *Nuclear Technology*, vol. 180, no. 2, pp. 205-215, 2012.
23. S. Singh, P.K. Jain, and Rizwan-uddin, "Finite Integral Transform Method to Solve Asymmetric Heat Conduction in a Multilayer Annulus with Time-Dependent Boundary Conditions," *Nuclear Engineering and Design*, vol. 83, no. 2, pp. 144-154, 2011.
24. P.K. Jain, S. Singh, and Rizwan-uddin, "An Exact Analytical Solution for Two-Dimensional, Unsteady, Multilayer Heat Conduction in Spherical Coordinates," *International Journal of Heat and Mass Transfer*, vol. 53, no. 9-10, pp. 2133-2142, 2010.
25. P.K. Jain, A. Tentner, and Rizwan-uddin, "A Lattice Boltzmann Framework to Simulate Boiling Water Reactor Core Hydrodynamics," *Computers and Mathematics with Applications*, vol. 58, no. 5, pp. 975-986, 2009.
26. P.K. Jain, S. Singh, and Rizwan-uddin, "Analytical Solution to Transient Asymmetric Heat Conduction in a Multilayer Annulus," *Journal of Heat Transfer*, vol. 131, no. 1, pp. 011304(1-7), 2009.
27. S. Singh, P.K. Jain, and Rizwan-uddin, "Analytical Solution to Transient Heat Conduction in Polar Coordinates with Multiple Layers in Radial Direction," *International Journal of Thermal Sciences*, vol. 47, no. 3, pp. 261-273, 2008.
28. P.K. Jain and Rizwan-uddin, "Numerical Analysis of Supercritical Flow Instabilities in a Natural Circulation Loop," *Nuclear Engineering and Design*, vol. 238, no. 8, pp. 1947-1957, 2008.
29. P.K. Jain, Y. Gu, and Rizwan-uddin, "Broadcasting Engineering Laboratories, Audio/Video, and Data, in Real-Time over the Internet," *Advances in Engineering Education*, vol. 1, no. 2, pp. 1-17, 2008.

### **Publications: Technical Proceedings**

1. M. Ross, P.K. Jain, "Multiphysics Modeling in COMSOL to Understand Thermal Behavior of the High Flux Isotope Reactor Core with a Low-enriched Uranium Silicide Fuel," submitted to the COMSOL Conference 2024, Boston MA, October 2-4, 2024.
2. C.W. Sizemore, et al., "High Flux Isotope Reactor Low-Enriched Uranium Conversion Activities – 2024 Status Update," presented at the U.S. High-Performance Research Reactor (USHPRR) Project Update Meeting, Augusta, Georgia, Jun. 25-27, 2024.
3. P.K. Jain, K. Borowiec, E.L. Popov, and C. Sizemore, "Involute Working Group: Updates from HFIR on Verification and Validation of CFD to support LEU Fuel Conversion," presented at the European Research Reactor Conference (RRFM) 2024, Warsaw, Poland, Apr. 21-24, 2024.
4. C.W. Sizemore, et al., "High Flux Isotope Reactor Low-Enriched Uranium Conversion Project Overview," in *Proceedings of the European Research Reactor Conference (RRFM) 2024*, Warsaw, Poland, Apr. 21-24, 2024.
5. C.W. Sizemore, et al., "Fuel Conversion Efforts at the High Flux Isotope Reactor – a 2023 Status Update," in *Proceedings of the 2023 ANS Annual Winter Meeting*, Washington D.C., Nov. 12-15, 2023.
6. C.W. Sizemore, et al., "High Flux Isotope Reactor Low-Enriched Uranium Conversion Activities –RERTR 2023," presented at the RERTR-2023: International Meeting on Reduced Enrichment for Research and Test Reactors, Denver, Colorado, Nov. 5-8, 2023.

7. P.K. Jain, "COMSOL Results for the Proposed LEU Silicide Fuel Designs under 95 MW Nominal Conditions for HFIR Conversion," presented at the RERTR-2023: International Meeting on Reduced Enrichment for Research and Test Reactors, Denver, Colorado, Nov. 5-8, 2023.
8. P.K. Jain, M. Sitek, "Multiphysics Modeling Results for the High Flux Isotope Reactor to Support its LEU Conversion," presented at the COMSOL Conference 2023, Munich, Oct. 25-27, 2023.
9. P.K. Jain, "COMSOL Multiphysics Modeling Results for the Low-Enriched Uranium-Silicide Conversion of the High Flux Isotope Reactor," lightning talk presented at the 20th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-20), Washington DC, Aug. 20-25, 2023.
10. B. Sieh, H. Bindra, P.K. Jain, C. Petrie, and N. See, "Air Ingress and DLOFC Studies in Scaled HTGR Geometry Using Additively Manufactured TCR Fuel Elements," In Proceedings of the 20th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-20), Washington DC, USA, Aug. 20-25, 2023.
11. V.M. Rao, P.K. Jain, K. Nawaz, and E.L. Curzio, "A Triply-Periodic Minimal Surface Recuperator for Natural Gas Combustion Systems," ASME 2023 Power Conference (POWER-2023), Aug. 2023.
12. V. Yadav, V. Agarwal, P.K. Jain, P. Ramuhalli, X. Zhao, C. Ulmer, J. Carlson, D. Eskins, and R. Iyengar, "Technical Challenges and Gaps in Integration of Advanced Sensors, Instrumentation, and Communication Technologies with Digital Twins for Nuclear Application," in Proceedings of the 13th International Topical Meeting on Nuclear Plant Instrumentation, Control and Human-Machine Interface Technologies (NPIC&HMIT 2023), Knoxville, Tennessee, Jul. 2023.
13. C.W. Sizemore, P.K. Jain, et al., "High Flux Isotope Reactor Low-Enriched Uranium Conversion Activities – 2023 Status Update," 2023 U.S. High-Performance Research Reactor (USHPRR) Project Update Meeting, Corvallis, Oregon, Jun. 2023.
14. P.K. Jain, "Opportunities for Digital Twins to Define the Future of Nuclear Energy Systems," Panel Presentation at the 2023 ANS Annual Meeting, Indianapolis, USA, Jun. 2023.
15. D. Chandler, P.K. Jain, et al., "Brief Overview of Reactor Core Design, Modeling, and Simulation Capabilities," Slicer Users Group, Knoxville, Tennessee, May 2023.
16. P.K. Jain, "Advancing the Science & Technology to Accelerate the Deployment of Advanced Reactors," presented at the CARD 2023: Conference for Advanced Reactor Deployment, College Station, Texas, Feb. 2023.
17. P.K. Jain, and S. Nelson, "Security-by-Design Approach to Reduce the Insider Threat and Sabotage Risks for Small Modular Reactors (SMRs)," Presentation to International Nuclear Security Sponsors and Stakeholders, Jan. 2023.
18. C.W. Sizemore, P.K. Jain, et al., "High Flux Isotope Reactor Low-Enriched Uranium Conversion Activities – 2022 Status Update," In Proceedings of the Reduced Enrichment Research and Test Reactor (RERTR) Conference, Vienna, Austria, Oct. 2022.
19. A. Bergeron, P.K. Jain, et al., "Updates from the Involute Working Group," presented at the European Research Reactors Conference (RRFM) 2022, Budapest, Hungary, Jun. 2022.
20. B.J. Ade et al., "Transformational Challenge Reactor Design Characteristics," presented at the International Conference on Physics of Reactors 2022 (PHYSOR 2022), Pittsburgh, PA, USA, May 15-20, 2022.
21. N.S. Panicker, R. Chaudhary, M.O. Delchini, V.M. Rao, and P.K. Jain, "Large Eddy Simulation Study of Aluminum Smelting Process using OpenFOAM," presented at the 7th Thermal and Fluids Engineering Conference (Hybrid), University of Nevada, Las Vegas, NV, USA, May 16-18, 2022.
22. P.K. Jain, J. Weinmeister, and B.J. Ade, "CFD Modeling for the Transformational Challenge Reactor Preliminary Design," presented at the International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-19), Virtual Meeting, Mar. 6-11, 2022.
23. I. Jarrah, M.O. Delchini, V. Badalassi, P.K. Jain, and J. Gounley, "Implementation of the Energy Equation Solver to the Lattice Boltzmann Method-based Code PRATHAM," presented at the International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-19), Virtual Meeting, Mar. 6-11, 2022.
24. J. Weinmeister, A.S. Sabau, and P.K. Jain, "Additively Manufactured Surface Heat Transfer Enhancements for the Transformational Challenge Reactor," to be presented at the International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-19), Virtual Meeting, Mar. 6-11, 2022.



25. V.M. Rao, V. Kumar, A. Anderson, J. Grogan, and P.K. Jain, "Computational Methodology to Simulate Pyrometallurgical Processes in a Secondary Lead Furnace," to be presented at the REWAS 2022 Symposia, TMS 2022 Annual Meeting & Exhibition, Anaheim, CA, USA, Feb. 27-Mar. 3, 2022.
26. C.J. Jesse, J. Weinmeister, P.K. Jain, and B.J. Ade, "Flattening the Radial Temperature Profile across the Transformational Challenge Reactor Core," presented at the Transactions of 2021 ANS Winter Meeting and Technology Expo, Washington, DC, USA, Nov. 2021.
27. B.J. Ade, P.K. Jain, J. Weinmeister, and B.R. Betzler, "The Impact of Temperature Modeling Assumptions for the Transformational Challenge Reactor," presented at the Transactions of 2021 ANS Annual Meeting, Jun. 13-16, 2021.
28. P.K. Jain and N. See, "Advanced CFD and Multiphysics Design Exploration at ORNL," presented at Siemens' Digital Twin Conference for the US Dept of Energy, Apr. 21, 2021.
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37. P.K. Jain, "Thermal-Hydraulics Modeling and Simulation Capabilities for Advanced Reactor Design and Safety Evaluations," presented at the 2019 Global Center for Nuclear Energy Partnership (GCNEP) Working Group Meeting, Dec. 2019.
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### Publications: Technical Reports

1. B. Hizoum, K. Borowiec, and P.K. Jain, "Estimating Fuel-Segregation and Non-bond Uncertainty Factors for HFIR HEU Fuel Plates using COMSOL Multiphysics," ORNL/TM-2024/3192, May 2024.
2. B. Hizoum, K. Borowiec, and P.K. Jain, "Estimating Fuel-Segregation and Non-bond Uncertainty Factors for HFIR LEU Fuel Plates using COMSOL Multiphysics," ORNL/TM-2024/3193, May 2024.
3. N.S. Panicker, V.M. Rao, G. Bazaz, and P.K. Jain, "Design and Development of a Waste Heat to Power Device using Computational Fluid Dynamics Simulations," ORNL/TM-2023/3114, Sep. 2023.
4. S. Nelson, P.K. Jain, and A. Huning, "Security by Design: A Plant Design and Component-Based Approach to Technical Solutions to Insider and Outsider Threat," ORNL/TM-2023/2850, May 2023.
5. V. Yadav, V. Agarwal, P.K. Jain, P. Ramuhalli, X. Zhao, C. Ulmer, J. Carlson, D. Eskins, and R. Iyengar, "State-of-Technology and Technical Challenges in Advanced Sensors, Instrumentation, and Communication to Support Digital Twin for Nuclear Energy Application," INL/RPT-23-70853, Feb. 2023.
6. D. Chandler, and P.K. Jain, "FY2022 Review of Thermal Test Reactor Capabilities Functional Requirements and Preconceptual Core Designs," ORNL/TM-2022/2720, Jan. 2023.
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9. N.S. Panicker, R. Chaudhary, M.O. Delchini, V.M. Rao, and P.K. Jain, "Computational Fluid Dynamics Simulations to Support Efficiency Improvements in Aluminum Smelting Process," ORNL/TM-2021/2341, NFE-19-07798, Dec. 2021.
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22. C. Carathers et al., "Oak Ridge National Laboratory HFIR OFE-488 Fuel Element Failure Causal Theory Evaluation Interim Report," ORNL/TM-2019/1120, Feb. 2019.
23. K. Nawaz, M. Sandlin, C. Cramer, A. Elliot, P.K. Jain, E. Lara-Curzio, and B. Fricke, "Development of Next-Generation Heat Exchangers for Hybrid Power Generation," ORNL/SPR-2018/1063, Oct. 2018.
24. B.R. Betzler, B.J. Ade, A.J. Wysocki, M.S. Greenwood, K.G. Field, J.M. Risner, P.K. Jain, J.R. Burns, B.D. Hiscox, and K.A. Terrani, "Transformational Challenge Reactor Preconceptual Design Incorporating Rapid Prototyping via Advanced Manufacturing," ORNL/SPR-2018/1008, Sep. 2018.
25. D. Chandler, B. Betzler, D. Cook, G. Ilas, P.K. Jain, and D. Renfro, "Feasibility Studies for High Flux Isotope Reactor Conversion to Low-Enriched Uranium U3Si2 Fuel," In Press, ORNL TM Report, Oak Ridge National Laboratory, Oak Ridge, Tenn., Oct. 2017.
26. P.K. Jain, "Independent Review of C-HFIR-2017-023 titled Design and Analysis of an Irradiation Target Capsule for the Production of Pu-238 using NpO<sub>2</sub> Pellets," Aug. 2017.
27. P.K. Jain, "Independent Review of C-HFIR-2016-041 titled Safety Basis Temperature and Expansion Calculation for Low Heat Flux SiC Cladding Rabbit Capsules," Mar. 2017.
28. R.J. Belles, P.K. Jain, and J.J. Powers, "Oak Ridge National Laboratory Support of Non-Light Water Reactor Technologies: Capabilities Assessment for NRC Near-term Implementation Action Plans for Non-Light Water Reactors," ORNL/TM-2017/117, Oak Ridge National Laboratory, Oak Ridge, Tenn., Mar. 2017.
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35. D.G. Renfro, D. Chandler, D. Cook, G. Ilas, P.K. Jain, and J. Valentine, "Preliminary Evaluation of Alternate Designs for HFIR Low-Enriched Uranium Fuel," ORNL/TM-2014/154, Oak Ridge National Laboratory, Oak Ridge, Tenn., Oct. 2014.

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40. P.K. Jain, "Simulation of Two-Phase Dynamics using Lattice Boltzmann Method," Ph.D. dissertation, Univ. of Illinois at Urbana-Champaign, Urbana, IL, USA, 2010.
41. P.K. Jain, "Numerical Analysis of Flow Stability in a Natural Circulation Loop with Supercritical Fluid," M.Sc. dissertation, Univ. of Illinois at Urbana-Champaign, Urbana, IL, USA, 2006.

### Recent Invited Presentations

1. P.K. Jain, "Panel Discussion on V&V and UQ of Machine Learning for Reactor Thermal Hydraulics: Progress and Future Opportunities," Invited panel presentation at the ANS Annual Conference 2024, Las Vegas, Nevada, USA, Jun. 16-19, 2024.
2. P. Ramuhalli, P.K. Jain, W. Williams, M. Muhlheim, X. Zhao, A.G. Yigitoglu, D.D. Wet, A. Raj, "Digital Technologies for Nuclear Energy Transformation," Invited presentation to the Diablo Canyon Power Plant's Operational Leadership, Jun. 11, 2024.
3. P.K. Jain, "Need for 'AI-enabled' Digital Twins to Help Address Key Challenges with the Deployment of New Nuclear," Invited panel presentation at the ASME's CARD 2024: Conference for Advanced Reactor Deployment, Charlotte, North Carolina, USA, Mar. 26-28, 2024.
4. P.K. Jain, "Big AI Ideas to Address Key Grand Challenges with the Nuclear Deployment," Invited presentation at the Technical Meeting on the Deployment of Artificial Intelligence Solutions for the Nuclear Power Industry: Considerations and Guidance, U.S. Nuclear Regulatory Commission (US NRC) Headquarters in Rockville, Maryland, USA, Mar. 18-21, 2024.
5. P.K. Jain, Invited Panelist at the Baker Hughes Energy Frontiers Summit, 2023.
6. P.K. Jain, "Panel Discussion on Digital Twins for Risk and Safety Assessments," in Proc. American Nuclear Society (ANS) Meeting, Anaheim, CA, USA, Jun. 12-16, 2022.
7. P.K. Jain, "Panel Discussion on Machine Learning for Reactor Thermal Hydraulics: Progresses, Challenges, and Opportunities," in Proc. American Nuclear Society (ANS) Meeting, Anaheim, CA, USA, Jun. 12-16, 2022.
8. C. Sizemore, P.K. Jain, et al., "High Flux Isotope Reactor Low-Enriched Uranium Conversion Activities – March 2022 Status Update," presented at the U.S. High-Performance Research Reactor (USHPRR) Silicide Meeting, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN, USA, Mar. 29, 2022.
9. N.S. Panicker, P.K. Jain, et al., "Large Eddy Simulation Study of Aluminum Smelting Process using OpenFOAM," presented at the 7th Thermal and Fluids Engineering Conference (TFEC), Virtual/In-Person Conference, May 16-18, 2022.

### References

Available upon request.