

Prashant K. Jain

CONTACT INFORMATION	Thermal Hydraulics and Irradiation Engineering Group Reactor and Nuclear Systems Division Oak Ridge National Laboratory 1 Bethel Valley Road Oak Ridge, TN 37923 USA	<i>Phone:</i> +1-865-574-6272 <i>Fax:</i> +1-865-574-2032 <i>E-mail:</i> jainpk@ornl.gov
RESEARCH INTERESTS	Computational Fluid Dynamics (CFD), Lattice Boltzmann Method, High Performance Parallel Computing, Multi Physics Couplings, Reactor Thermal Hydraulics, Single and Multi-phase Flows, Turbulence, Boiling and Heat Transfer, Analytical Benchmarks, Reactor Flow Instabilities	
EDUCATION	University of Illinois at Urbana-Champaign , Urbana IL, USA Ph.D., Nuclear Engineering, May 2010 <ul style="list-style-type: none">• Thesis Topic: <i>Simulation of two phase dynamics using Lattice Boltzmann Method</i>• Advisor: Professor Rizwan-uddin• Minor in Material Science & Engineering M.S., Nuclear Engineering, August 2006 <ul style="list-style-type: none">• Thesis Topic: <i>Numerical analysis of flow stability in a natural circulation loop with supercritical fluid</i>• Advisor: Professor Rizwan-uddin Indian Institute of Technology (IIT) Bombay , Mumbai, INDIA B.Tech., Mechanical Engineering, August 2004 <ul style="list-style-type: none">• Thesis Topic: <i>Heat removal mechanisms in a Pressurized Heavy Water Reactor (PHWR) during off-normal conditions</i>• Advisor: Professor Kannan N. Iyer	
PROFESSIONAL EXPERIENCE	Nuclear CFD Engineer Reactor and Nuclear Systems Division, Oak Ridge National Laboratory (ORNL)	Feb 2012 to present
	Postdoctoral Research Associate Reactor and Nuclear Systems Division, Oak Ridge National Laboratory (ORNL)	2010–2012
	Graduate Research Assistant Nuclear, Plasma and Radiological Engineering, University of Illinois at Urbana Champaign	2005–2010
	Graduate Summer Intern Idaho National Laboratory, Idaho Falls ID, USA Idaho National Laboratory, Idaho Falls ID, USA Oak Ridge National Laboratory, Oak Ridge TN, USA	Summer 2009 Summer 2008 Summer 2006
	Guest Graduate Appointee Argonne National Laboratory, Argonne IL, USA	2007–2008

Graduate Teaching Assistant 2004–2006
Nuclear, Plasma and Radiological Engineering,
University of Illinois at Urbana Champaign

- NPRE-448: *Nuclear Systems Engineering and Design* with Prof. B.G. Jones
- NPRE-431: *Materials in Nuclear Engineering* with Prof. B.J. Heuser
- NPRE-451: *Nuclear Plasma and Radiological Engineering Laboratory* with Prof. B.G. Jones and Prof. Rizwan-uddin

Undergraduate Summer Intern Summer 2003
Crompton Greaves Limited, Mumbai, INDIA

HONORS AND
AWARDS

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.

2012 COMSOL Best Paper Award

- 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 contribution to the support to DOE in response to crisis at Fukushima Dai-ichi damaged reactors.

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 Dai-ichi.

2010 Mark Mills Award

- 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 the advancement of science and engineering related to the atomic nucleus.

Member of the Alpha Nu Sigma National Honor Society, since 2006

- The objective of the Alpha Nu Sigma Society is to recognize high scholarship, integrity, and potential achievement in applied nuclear science and nuclear engineering among outstanding students by means of membership in the Society.

Sargent and Lundy Fellowship, 2005–2006

- This competitive fellowship is awarded by the Sargent and Lundy, LLC to a graduate student who shows promise of making substantial research contributions in future nuclear reactor designs, and has demonstrated a strong academic performance.

Merit-cum-Means (MCM) Scholarship

- Recipient for all the four years of undergraduate degree, 2000–2004
- MCM scholarship is awarded each year by the Indian Institute of Technology (IIT) Bombay to selected undergraduate students on the basis of their academic excellence, and their available means of support.

ACADEMIC
ACHIEVEMENTS

Article published in the *Journal of Heat Transfer* 131(1):011304(1-7) was among the top 10 most downloaded articles in November 2008 (2008).

Paper in the ICONE-14 Conference was among the best 30 papers selected by the editors of the journal *Nuclear Engineering and Design* (2006).

Ranked in top 0.4% among over 150,000 students nationwide (All India Rank: 580) in the competitive Joint Entrance Examination (JEE) for securing admission to the India's most prestigious undergraduate engineering program offered by the IITs (Indian Institute of Technology) (2000).

Received ISHEER'98 award by the *Indian Society of Health Environment Education and Research* in recognition of my 6th position in the list of meritorious candidates from the state of Rajasthan in the Senior Secondary School Examination (1998).

Awarded Certificate of Merit by the *Ministry of Human Resources & Development* (Department of Education), Government of India in recognition of my 17th position in the list of meritorious candidates from the state of Rajasthan in the Secondary School Examination (1996).

REFEREED
JOURNAL
PUBLICATIONS

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, J.C. Gehin. Study of Fukushima Daiichi Nuclear Power Station Unit 4 Spent Fuel Pool. *Nuclear Technology*, 180(2):205-215, 2012.

S. Singh, P.K. Jain, Rizwan-uddin. Finite integral transform method to solve asymmetric heat conduction in a multilayer annulus with time-dependent boundary conditions. *Nuclear Engineering and Design*, 83(2):144-154, 2011.

P.K. Jain, S. Singh, Rizwan-uddin. An exact analytical solution for two-dimensional, unsteady, multilayer heat conduction in spherical coordinates. *International Journal of Heat and Mass Transfer*, 53(9-10):2133-2142, 2010.

P.K. Jain, A. Tentner, Rizwan-uddin. A lattice Boltzmann framework to simulate boiling water reactor core hydrodynamics. *Computers and Mathematics with Applications*, 58(5):975-986, 2009.

P.K. Jain, S. Singh, Rizwan-uddin. Analytical solution to transient asymmetric heat conduction in a multilayer annulus. *Journal of Heat Transfer*, 131(1):011304(1-7), 2009.

S. Singh, P.K. Jain, Rizwan-uddin. Analytical solution to transient heat conduction in polar coordinates with multiple layers in radial direction. *International Journal of Thermal Sciences*, 47(3):261-273, 2008.

P.K. Jain, Rizwan-uddin. Numerical analysis of supercritical flow instabilities in a natural circulation loop. *Nuclear Engineering and Design*, 238(8):1947-1957, 2008.

P.K. Jain, Y. Gu, Rizwan-uddin. Broadcasting engineering laboratories – audio/video and data – in real time over the internet. *Advances in Engineering Education*, 1(2):1-17, 2008.

REFEREED
CONFERENCE
PUBLICATIONS

P.K. Jain and J.D. Freels. Advanced Multiphysics Thermal Hydraulic Models for the High Flux Isotope Reactor. In: *Nuclear Reactor Thermal Hydraulics (NURETH-16) Conference*, Chicago, September 2015.

V.B. Khane, P.K. Jain. Steady State COMSOL Thermal-Hydraulics Models for ORNLs High Flux Isotope Reactor. In: *2013 ANS Winter Meeting and Nuclear Technology Expo*, Washington DC, November 10-14, 2013.

- J.D. Freels, P.K. Jain, C.J. Hurt. Investigation of Thermal Contact Gas Gap Conductance using COMSOL Version 4.3b. In: *2013 COMSOL Conference*, Boston, MA, October 9-11, 2013.
- D. Wang, P.K. Jain, J.D. Freels. Application of COMSOL Pipe Flow Module to Develop a High Flux Isotope Reactor (HFIR) System Loop Model. In: *2013 COMSOL Conference*, Boston, MA, October 9-11, 2013.
- A.S. Joshi, P.K. Jain, J.A. Mudrich, E.L. Popov. PRATHAM: Parallel Thermal Hydraulics Simulations using Advanced Mesoscopic Methods. In: *2012 ANS Winter Meeting and Nuclear Technology Expo*, San Diego, CA, November 11-15, 2012.
- J.N. Cantrell, E.J. Inclan, A.S. Joshi, E.L. Popov, P.K. Jain. CartGen++: Extending a CAD-Based Cartesian Mesh Generator for the Lattice Boltzmann Method. In: *2012 ANS Winter Meeting and Nuclear Technology Expo*, San Diego, CA, November 11-15, 2012.
- V.B. Khane, P.K. Jain, J.D. Freels. Development of CFD Models to Support LEU Conversion of ORNL's High Flux Isotope Reactor. In: *2012 ANS Winter Meeting and Nuclear Technology Expo*, San Diego, CA, November 11-15, 2012.
- V.B. Khane, P.K. Jain, J.D. Freels. COMSOL Simulations for Steady State Thermal Hydraulics Analyses of ORNL's High Flux Isotope Reactor. In: *COMSOL Conference*, Newton, Mass, October 3-5, 2012.
- J.D. Freels, P.K. Jain, R.W. Hobbs. Design and Nuclear Safety Related Simulations of Bare-Pellet Test Irradiations for the Production of Pu-238 in the High Flux Isotope Reactor using COMSOL. In: *COMSOL Conference*, Newton, Mass, October 3-5, 2012.
- J.D. Freels, P.K. Jain. Multiphysics Simulations in the Complex 3D Geometry of the High Flux Isotope Reactor Fuel Elements Using COMSOL. In: *COMSOL Conference*, Newton, Mass, October 13-15, 2011.
- P.K. Jain, J.D. Freels, D.H. Cook. COMSOL-based Multiphysics Simulations to Support HFIR's Conversion to LEU Fuel. In: *Trans. Amer. Nucl. Soc.*, 104:1064-1066, 2011.
- P.K. Jain, Rizwan-uddin. Artificial Interface Lattice Boltzmann (AILB) model for simulation of two-phase dynamics (invited). In: *Proceedings of 2010 American Nuclear Society (ANS) Winter Meeting*, Las Vegas NV, USA, November 7-11, 2010.
- P.K. Jain, E.L. Popov, G.L. Yoder, Rizwan-uddin. Parallel simulation of 2D/3D flows using lattice Boltzmann models (LBM). In: *Proceedings of 2010 American Nuclear Society (ANS) Winter Meeting*, Las Vegas NV, USA, November 7-11, 2010.
- P.K. Jain, Rizwan-uddin. Advances in lattice Boltzmann modeling (LBM) to simulate two-phase dynamics. In: *Proceedings of the 1st International Nuclear & Renewable Energy Conference (INREC-10)*, Amman, Jordan, March 21-24, 2010.
- S. Singh, P.K. Jain, Rizwan-uddin. Analytical solution of time-dependent multilayer heat conduction problems for nuclear applications. In: *Proceedings of the 1st International Nuclear & Renewable Energy Conference (INREC-10)*, Amman, Jordan, March 21-24, 2010.
- P.K. Jain, A. Tentner, Rizwan-uddin. LBM simulation of liquid drop coalescence driven by surface tension. In: *Proceedings of 2009 American Nuclear Society (ANS) Winter Meeting*, Washington DC, USA, November 15-19, 2009.

- P.K. Jain, A. Tentner, Rizwan-uddin. A lattice boltzmann framework for the simulation of boiling hydrodynamics in BWRs. In: *Proceedings of 2008 American Nuclear Society (ANS) Annual Meeting*, Anaheim CA, USA, June 8-12, 2008.
- P.K. Jain, Rizwan-uddin. A 3D, parallel LBM to simulate gravity driven bubbly and slug flows. In: *Proceedings of 2007 American Nuclear Society (ANS) Winter Meeting*, Washington DC, USA, November 11-15, 2007.
- P.K. Jain, Rizwan-uddin. Lattice Boltzmann Method (LBM) for nuclear engineering applications. In: *Proceedings of 2007 American Nuclear Society (ANS) Annual Meeting*, Boston MA, USA, June 24-28, 2007.
- P.K. Jain, S. Markidis, B.G. Jones, Rizwan-uddin, J.R. White, L.M. Bobek. Web-casting of nuclear reactor experiments. In: *Proceedings of American Nuclear Society (ANS) Winter Meeting*, Albuquerque NM, USA, November 12-16, 2006.
- K.D. Kim, P.K. Jain, Rizwan-uddin. Web- and System-code based, interactive, nuclear power plant simulators. In: *Proceedings of 5th International Topical Meeting on Nuclear Plant Instrumentation Controls, and Human Machine Interface Technology (NPIC & HMIT 2006)*, Albuquerque NM, USA, November 12-16, 2006.
- P.K. Jain, J.F. Stubbins, Rizwan-uddin. Interactive virtual laboratory for distance education in nuclear engineering. In: *Proceedings of PHYSOR-2006, American Nuclear Society's Topical Meeting on Reactor Physics*, Vancouver BC, Canada, Sept 10-14, 2006.
- P.K. Jain, Rizwan-uddin. Steady state and dynamic analyses of supercritical CO2 natural circulation loop. In: *Proceedings of ICONE-14, 14th International Conference on Nuclear Engineering*, Paper 89103, Miami FL, USA, July 17-20, 2006.
- P.K. Jain, Y. Gu, J.F. Stubbins, Rizwan-uddin. Broadcasting nuclear engineering laboratories – video and data – in real-time over the internet. In: *Proceedings of American Society of Engineering Education (ASEE) Annual Conference*, Chicago IL, USA, June 18-21, 2006.
- E. Edwards, A. Sweet, M. Blanchard, R. Agasie, P.K. Jain, Rizwan-uddin. Distance reactor laboratory and virtual tours. In: *Proceedings of 2006 American Nuclear Society (ANS) Annual Meeting*, Reno NV, USA, June 4-8, 2006.
- P.K. Jain. LabVIEW-based, interactive virtual laboratory for nuclear engineering education. In: *Proceedings of 2006 American Nuclear Society (ANS) Student Conference*, Troy NY, USA, March 30- April 1, 2006.
- P.K. Jain. Development of a real-time web-casting interface for system codes. In: *Proceedings of 2006 American Nuclear Society (ANS) Student Conference*, Troy NY, USA, March 30–April 1, 2006.
- 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., June 2014.
- D. Chandler, D.H. Cook, G. Ilas, P.K. Jain, D.G. Renfro. Conceptual Design Parameters for HFIR LEU U-Mo Fuel Conversion Experimental Irradiations, ORNL/LTR-2013/132, Oak Ridge National Laboratory, Oak Ridge, Tenn., March 2013.
- P.K. Jain, J.D. Freels, D.H. Cook. 3D COMSOL Simulations for Thermal Deflection of HFIR Fuel Plate in the "Cheverson-Kelley" Experiments, ORNL/TM-2012/138, Oak Ridge National Laboratory, Oak Ridge, Tenn., August 2012.

J. D. Freels, I. T. Bodey, R. V. Arimilli, F. G. Curtis, K. Ekici, and P. K. Jain. Preliminary Multiphysics Analyses of HFIR LEU Fuel Conversion using COMSOL, ORNL/TM-2011/7, Oak Ridge National Laboratory, Oak Ridge, Tenn., June 2011.

P.K. Jain. Simulation of two phase dynamics using Lattice Boltzmann Method. *Ph.D. Dissertation*, University of Illinois at Urbana Champaign, Urbana IL, USA, 2010.

P.K. Jain. Numerical analysis of flow stability in a natural circulation loop with supercritical fluid. *M.Sc. Dissertation*, University of Illinois at Urbana Champaign, Urbana IL, USA, 2006.

P.K. Jain. Heat removal mechanisms in a Pressurized Heavy Water Reactor (PHWR) during off-normal conditions. *B.Tech. Dissertation*, Indian Institute of Technology (IIT) Bombay, Mumbai, INDIA, 2004.

INVITED TALKS &
POSTER
PRESENTATIONS

P.K. Jain. Unveiling a New and Improved Thermal-Hydraulics Safety Basis Model of HFIR. ORNL RNSD Division Seminar, December 2015.

P.K. Jain and J.D. Freels. Advanced Multiphysics Thermal Hydraulic Models for the High Flux Isotope Reactor. Poster presentation at: 2015 COMSOL Conference, Boston, MA, October 2015.

D.G. Renfro, B. Betzler, D. Chandler, D. Cook, J. Freels, F. Griffin, R. Hale, G. Ilas, P.K. Jain, G. Kirk, C. McAmis, T. Muth, D. Pinkston, E.L. Popov, E. Sunny and J. Valentine. Continuing LEU Conversion Activities at the High Flux Isotope Reactor. Presentation at: the RERTR 2015 Conference, Seoul, S. Korea, October 2015.

P.K. Jain. Learn from COMSOL Multiphysics: 25 must have User-Centric features for any engineering analysis software. ORNL RNSD M&S Forum, July 2015.

D.G. Renfro, B. Betzler, D. Chandler, D. Cook, J. Freels, F. Griffin, R. Hale, G. Ilas, P.K. Jain, G. Kirk, C. McAmis, T. Muth, D. Pinkston, E.L. Popov, E. Sunny and J. Valentine. Continuing LEU Conversion Activities at the High Flux Isotope Reactor. Presentation at: the US High Performance Research Reactor (USHPRR) Working Meeting, Argonne IL, June 2015.

D. Pointer, J.J. Carbajo, D. Felde, P.K. Jain, J. March-Leuba, E.L. Popov, K. Robb, R. Salko and G.L. Yoder. Reactor and Nuclear System Thermal-Hydraulics. Poster Presentation at: the NSED Advisory Committee Review meeting at ORNL, April 2015.

P.K. Jain. Modeling and Simulation Activities in Nuclear Thermal Hydraulics and Irradiation Engineering at ORNL. Graduate Seminar Presentation at: the Dept. of Nuclear Engineering, Kansas State University, Manhattan, KS April, 2015.

P.K. Jain and J.D. Freels. 3D Multi-physics Analyses to Support Low Enriched Uranium (LEU) Conversion of HFIR. Poster presentation at: 2014 COMSOL Conference, Boston, MA, October 2014.

D.G. Renfro, D. Chandler, D. Cook, J. Freels, G. Ilas, P.K. Jain, T. Muth, D. Pinkston, and J. Valentine. Continuing LEU Conversion Activities at the High Flux Isotope Reactor. Presentation at: the USHPRR Working Group Meeting 2014, Richland, WA, July 29-31, 2014.

P.K. Jain and J.D. Freels. 3D Multi-physics Analyses to Support Low Enriched Uranium (LEU) Conversion of HFIR. Poster presentation at: ORNL Wigner Distinguished Lecture Series, July 28, 2014.

G. Davidson, T.M. Pandya, P.K. Jain, S.R. Johnson, D. Chandler, J.L. Peterson. Advanced Modeling and Simulation to Support LEU Conversion of HFIR. Poster Presentation at: the ORNL Science Advisory Board, June 2014.

P.K. Jain. COMSOL Multiphysics: A Toolkit for Irradiation Engineering and Isotope Production Analyses. Presentation at: the 2013 ORNL COMSOL Symposium, ORNL, June 17, 2013.

P.K. Jain. Modeling and Simulation Activities in Nuclear Thermal Hydraulics and Irradiation Engineering at ORNL. Graduate Seminar Presentation at: the Dept. of Chemical and Bio-Chemical Engineering, Missouri University of Science and Technology, Rolla, April 24, 2013.

P.K. Jain. Lattice Boltzmann Models (LBM) for two-phase thermo-hydro-dynamics. Invited talks at:

- *Nuclear Science and Technology Division Seminar* at the Oak Ridge National Laboratory (ORNL), Oak Ridge TN, USA, December 03, 2009.
- *Graduate Seminar* at the Department of Nuclear, Plasma and Radiological Engineering, University of Illinois at Urbana Champaign, Urbana IL, USA, November 03, 2009.
- *Environmental Energy Technologies Division Seminar* at the Lawrence Berkeley National Laboratory (LBNL), Berkeley CA, USA, October 15, 2009.
- *Nuclear Engineering Division Seminar* at the Argonne National Laboratory (ANL), Argonne IL, USA, April 17, 2009.

P.K. Jain, Rizwan-uddin. Lattice Boltzmann method for nuclear engineers. Presentation at: *International Conference of Mesoscopic Methods in Engineering and Science (ICMMES 2007)*, Munich, Germany, July 16-20, 2007.

P.K. Jain, S. Singh, Y. Yan, Rizwan-uddin. Advanced computing to bridge micro and macro: LBM, Advanced CFD and Coupled CFD-System codes. Poster at: *Computational Engineering and Science Conference (CESC-2007)*, Washington DC, USA, April 10-12, 2007.

PROFESSIONAL TRAININGS

STAR-CCM+ v.8 Best Practices Training, STAR Global Conference 2013, Orlando FL, USA, March 18-20 2013.

TACC SSI 2012 Texas Advanced Computing Center Summer Supercomputing Institute, University of Texas at Austin, Austin TX, USA, July 30-August 03, 2012.

Short Course on Thermal-Hydraulics of Nuclear Systems, Hosted by the Energy Institutes at City College of New York and University of Wisconsin, Madison, Washington DC, USA, October 24-28, 2011.

COMSOL Multiphysics 2-Day Intensive Training, Charlotte NC, USA, September 2010.

Course on Introduction to LS-DYNA, with LS-PrePost, Livermore Software Technology Corporation (LSTC), Troy MI, USA, September 2010.

US Department of Energy's Training Course on Methods for Reviewing Safety Analysis Reports for Packagings and Performing Confirmatory Analysis, Lawrence Livermore National Laboratory (LLNL), Pleasanton CA, USA, May 2010.

COMPUTER SKILLS *Computational Packages:* MATLAB, Mathematica

Pre-Post Processors: Pro-ENGINEER, TecPlot, VisIt, LS-PrePost, SpaceClaim

CFD and other Softwares: COMSOL Multiphysics, Star-CCM+, Fluent, ANSYS Workbench, LS-DYNA, LabView, NIST Steam/REFPROP

Programming Languages: Fortran 77/90, C, Python, Perl, UNIX shell scripting

Parallel Programming: MPI, OpenMP

REFeree SERVICE Technical reviewer for:

- *International Journal of Heat and Mass Transfer*
- *International Journal of Thermal Sciences*
- *ANS Journal of Nuclear Technology*
- *Annals of Nuclear Energy*
- *ASME/JSME 8th Thermal Engineering Joint Conference*
- *Advances in Engineering Education*