Ran Kong

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Education

Ph.D., Nuclear Engineering

- Purdue University, West Lafayette, IN USA 08/2017 ~ 08/2018
- The Pennsylvania State University, University Park, PA USA 08/2013 ~ 07/2017

M.Eng., Nuclear Engineering

- Shanghai Jiao Tong University, Shanghai, China 09/2010 ~ 03/2013

B.S., Energy and Power Engineering

- Shandong University, Jinan, Shandong, China 09/2005 ~ 07/2009

Research Interests

- Thermal-hydraulics Experiments and Modeling
- Computational Fluid Dynamics Simulation
- Liquid Metal in Nuclear Engineering Applications
- Two-phase Flow Instrumentation Development
- Advanced Reactor Design and Reactor Safety Analysis

Professional Experience

Postdoctoral Research Associate (Purdue University) 09/2018 ~ present

Graduate Research Assistant (Purdue University) 08/2017 ~ 08/2018

- Research group leader of the Thermal-hydraulics and Reactor Safety Laboratory (TRSL) at Purdue University directed by Dr. Seungjin Kim and Dr. Mamoru Ishii
- Project leader: Thermal-hydraulics of the HYbrid fast/thermal core configuration Subcritical Testbed (HYST)
  - Performed literature review on the state-of-the-art in liquid lead-bismuth-eutectic (LBE) experiments
  - Developing instrumentation plan (thermocouples, flowmeters, pressure transducer) and assisting Niowave in prototypic fast core design and experiments
  - Developing plans for experiments including test procedures and test conditions
  - Performing CFD analysis (ANSYS and Star-CCM) to evaluate the performance of LBE fast core with 19 heater rods (pressure drop and heat transfer)
- Project leader: Experimental study and CFD design tool development for the sodium cartridge loop in the Versatile Test Reactor (VTR)
  - Performed scaling analysis to investigate feasibility of using water loop to reflect physics in sodium loop

  - Performing CFD analysis (ANSYS and Star-CCM) to evaluate the performance of sodium cartridge loop and effects of different coolant and boundary conditions
  - Designing a water loop test facility to simulate the sodium cartridge loop in VTR
- Project leader: Separate effects of inclination on air-water two-phase flow
  - Designed and constructed a robust inclined air-water two-phase flow test facility
  - Performing experiments using the inclined test facility to investigate the effects of inclination on hydrodynamics of two-phase flow
- Project leader: Jet impingement model evaluation and development
  - Performed comprehensive literature review on jet impingement phenomena, experiments, models and CFD simulation
  - Performed a comprehensive jet impingement model evaluation
  - Improving jet force model to address potential non-conservatisms
- Project leader: Two-phase flow in high-temperature high-pressure conditions
  - Designed and constructing a high- temperature (~280 °C) high-pressure (~7MPa) test facility
  - Developing optical fiber probe technique for high-temperature high-pressure two-phase flow experiments
- Project leader: Horizontal two-phase flow in a large diameter pipe
  - Designed and reconstructed the large-diameter horizontal air-water two-phase flow test facility
  - Performed experiments in the horizontal test facility using various measurement techniques including conductivity probe, gamma densitometer, and image analysis approach to investigate the relative motion of phases in horizontal two-phase flow.
- Developed training materials for new group members
- Day-to-day supervisor of graduate and undergraduate researchers

Graduate Research Assistant (The Pennsylvania State University) 08/2013 ~ 07/2017

- Research group member of the Advanced Multi-Phase Flow Laboratory (AMFL) at the Pennsylvania State University directed by Dr. Seungjin Kim
- Project leader: Experiments on scalability of horizontal two-phase flow in small and large diameter pipes
  - Designed and constructed a large diameter (101.60 mm ID) test facility for horizontal air-water two-phase flow
  - Performed frictional pressure loss analysis in various flow orientations in straight pipes
  - Performed one-dimensional drift-flux analysis in horizontal bubbly, plug and slug flows
  - Improved interfacial area transport modeling for horizontal bubbly flow
  - Developed image analysis algorithms for horizontal plug flow using MATLAB
  - Skilled at conductivity probe fabrication and application
- Developed models to account for the effects of vertical-downward elbow on two-phase flow

- Developed training materials for new group members
- Day-to-day supervisor of graduate and undergraduate researchers

Graduate Research Assistant (Shanghai Jiao Tong University) 09/2010 ~ 06/2013

- Member of the research group directed by Dr. Thomas K.S. Liang at Shanghai Jiao Tong University
- Project leader: Thermal-hydraulic behavior of spent fuel pool in nuclear power plants
  - Developed RELAP5 model to investigated thermal-hydraulic behavior of spent fuel pool under normal and accident operation conditions
- Participated in research project uncertainty analysis of the effect of nuclear power plant state parameters on LBLOCA in AP1000 using RELAP5

Grant Application Experience

- ERI-NRC Grant, "Jet Impingement Model Evaluation and Development". (awarded) PI: Seungjin Kim, Co-PI: Mamoru Ishii.
- INL-DOE Grant, "Experimental Study and CFD Design Tool Development for the Cartridge Loop in the Versatile Test Reactor". (awarded) PI: Seungjin Kim, Co-PI: Mamoru Ishii.
- Niowave Inc. Grant, "Thermal-Hydraulics of the HYbrid fast/thermal core configuration Subcritical Testbed (HYST)". (awarded) PI: Seungjin Kim.

Teaching Experience

Guest Lecturer

- NUCL 350: Nuclear Thermal-Hydraulics I, Purdue University (Fall 2019), Instructor: Dr. Seungjin Kim

Teaching Assistant

- NucE 431W: Nuclear Reactor Core Design Synthesis, The Pennsylvania State University (Spring 2015), Instructor: Dr. Jack Brenizer
- NucE 430: Design Principles of Reactor Systems, The Pennsylvania State University (Fall 2014), Instructor: Dr. Seungjin Kim
- NucE 431W: Nuclear Reactor Core Design Synthesis, The Pennsylvania State University (Spring 2014), Instructor: Dr. Jack Brenizer
- NucE 430: Design Principles of Reactor Systems, The Pennsylvania State University (Fall 2013), Instructor: Dr. Seungjin Kim

Publications

Refereed Journal Publications:

1. Kim, S., **Kong, R.,** (*Under Review*). Separate-Effect Experiments and Modeling for Two-Phase Flow Under Geometric Restrictions. *Invited for publication in the Special Issue of NURETH-18 of Nuclear Engineering and Design*.

2. **Kong, R.,** Kim, S., Ishii, M., (*Submitted*). Characteristics of Jet Impingement in High-Energy Piping Systems and Model Evaluation.

3. **Kong, R.,** Kim, S., Ishii, M., 2020. Review on Jet Impingement in High-Energy Piping Systems, *Nuclear Engineering and Design*, 357, 110411.

4. **Kong, R.,** Rau, A., Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2019. A Robust Image Analysis Technique for the Study of Horizontal Air-Water Plug Flow. *Experimental Thermal and Fluid Science*, 102, 245-260.

5. **Kong, R.,** Zhu, Q., Kim, S., Ishii, M., Bajorek, S., Tien, K., Hoxie, C., 2018. Void Fraction Prediction and One-Dimensional Drift-Flux Analysis for Horizontal Two-Phase Flow in Different Pipe Sizes. *Experimental Thermal and Fluid Science*, 99, 433-445.

6. **Kong, R.,** Qiao, S., Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2018. Interfacial Area Transport Models for Horizontal Air-Water Bubbly Flow in Different Pipe Sizes. *International Journal of Multiphase Flow*, 106, 46-59.

7. Qiao, S., **Kong, R.,** Kim, S., 2018. Air-Water Two-Phase Bubbly Flow across 90° Vertical Elbows, Part II: Modeling. *International Journal of Heat and Mass Transfer*, 123, 1238-1252.

8. Lu, C., **Kong, R.,** Qiao, S., Larimer, J., Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2018. Frictional Pressure Drop Analysis for Vertical and Horizontal Air-Water Two-Phase Flows in Different Pipe Sizes. *Nuclear Engineering and Design*, 332, 147-161.

9. **Kong, R.,** Rau, A., Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2018. Experimental Study of Horizontal Air-Water Plug-to-Slug Transition Flow in Different Pipe Sizes. *International Journal of Heat and Mass Transfer*, 123, 1005-1020.

10. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2018. Effects of Pipe Size on Horizontal Two-Phase Flow: Flow Regimes, Pressure Drop, Two-Phase Flow Parameters, and Drift-Flux Analysis. *Experimental Thermal and Fluid Science*, 96, 75-89.

11. **Kong, R.,** Rau, A., Lu, C., Gamber, J., Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2018. Experimental Study of Interfacial Structure of Horizontal Air-Water Two-Phase Flow in a 101.6 mm ID Pipe. *Experimental Thermal and Fluid Science*, 93, 57-72.

12. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., 2017. Experimental Investigation of Horizontal Air-Water Bubbly-to-Plug and Bubbly-to-Slug Transition Flows in a 3.81 cm ID Pipe. *International Journal of Multiphase Flow*, 94, 137-155.

13. **Kong, R.,** Kim, S., 2017. Characterization of Horizontal Air-water Two-phase Flow. *Nuclear Engineering and Design*, 312, 266-276.

14. Worosz, T., Bernard, M., **Kong, R.,** Toptan A., Kim, S., Hoxie, C., 2016. Sensitivity Studies on the Multi-Sensor Conductivity Probe Measurement Technique for Two-phase Flows. *Nuclear Engineering and Design*, 310, 552-563.

Refereed Conference Proceedings and Presentations:

1. **Kong, R.,** Kim, S., Ishii, M., Characteristics of Jet Impingement in High-Energy Piping Systems and Model Evaluation, *Proceeding of 2020 US-Japan Seminar on Two-phase Flow Dynamics*, May 17-20, Ann Arbor, MI USA.
2. Marquardt, J., **Kong, R.,** Kim, S., Identification of Plug Bubble by Segmentation of Images Using a Residual Convolutional Neural Network, *Proceeding of 2020 ANS Student Conference*, March 26-28, Raleigh, NC USA.
3. Ryan, D., Dix, A., Kang, D., **Kong, R.,** Bian, J., Kim, S., Preliminary Inclined Two-Phase Flow Experiments, *Proceeding of 2020 ANS Student Conference*, March 26-28, Raleigh, NC USA.
4. Quan, Z., **Kong, R.,** Kim, S., Ishii, M., Pressure Distribution in Free and Impinging Jets for High-Energy Piping Systems, *Proceeding of 2020 ANS Student Conference*, March 26-28, Raleigh, NC USA.
5. Dix, A., **Kong, R.,** Wang, G., Kim, S., Ishii, M., Scaling Analysis of the Sodium Cartridge Loop in the Versatile Test Reactor, *Proceeding of 2020 ANS Student Conference*, March 26-28, Raleigh, NC USA.
6. **Kong, R.,** Bian, J., Ryan, D., Zhu, Q., Ishii, M., Kim, S., Relative Motion between Phases in Horizontal Gas-Dispersed Flow, *Proceedings of 2019 18th International Meetings on Nuclear Reactor Thermal Hydraulics (NURETH-18)*, August 18-22, Portland, OR USA.
7. Kim, S., **Kong, R.,** Separate-Effect Experiments and Modeling for Two-Phase Flow under Geometric Restrictions, *Proceedings of 2019 18th International Meetings on Nuclear Reactor Thermal Hydraulics (NURETH-18)*, Keynote, August 18-22, Portland, OR USA.
8. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., Characteristic Effects of Pipe Size on Horizontal Two-Phase Flow, *Proceedings of 2018 American Nuclear Society Annual Meeting*, June 17-21, Philadelphia, PA USA.
9. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., Interfacial Area Transport in Horizontal Bubbly Flow, *Proceedings of 2018 American Nuclear Society Annual Meeting*, June 17-21, Philadelphia, PA USA.
10. **Kong, R.,** Zhu, Q., Kim, S., Ishii, M., Drift-flux Analysis for Horizontal Two-phase Flow, *Proceedings of 2018 American Nuclear Society Annual Meeting*, June 17-21, Philadelphia, PA USA.
11. Zhu, Q., **Kong, R.,** Kim, S., Ishii, M., Drift-Flux Analysis for Downward Air-Water Two-Phase Flow, *Proceedings of 2018 American Nuclear Society Annual Meeting*, June 17-21, Philadelphia, PA USA.
12. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., Drift-flux Analysis in Horizontal Two-phase Flow, *Proceedings of 2016 American Nuclear Society Winter Meeting*, November 6-10, Las Vegas, NV USA.
13. Rau, A., **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., Image Analysis for Plug Bubble in Horizontal Flow, *Proceedings of 2016 American Nuclear Society Winter Meeting*, November 6-10, Las Vegas, NV USA.

14. **Kong, R.,** Lu, C., Rau, A., Kim, S., Horizontal Two-Phase Flow in a Large Diameter (4-in.) Pipe, Poster presented at the *2016 American Nuclear Society Winter Meeting*, November 6-10, Las Vegas, NV USA.

15. Rau, A., **Kong, R.,** Lu, C., Kim, S., Image Processing in Horizontal Plug Flow, Poster presented at the *2016 American Nuclear Society Winter Meeting*, November 6-10, Las Vegas, NV USA.

16. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., Experimental Study of Horizontal Air-water Plug-to-Slug Transition Flow, *Proceedings of 2016 11th International Topical Meeting on Nuclear Thermal Hydraulics, Operation and Safety (NUTHOS-11)*, October 9-13, Gyeongju, Korea.

17. **Kong, R.,** Kim, S., Bajorek, S., Tien, K., Hoxie, C., Evaluation of Interfacial Area Transport Models for Horizontal Bubbly Flow, *Proceedings of 2016 International Topical Meeting on Advances in Thermal Hydraulics (ATH-2016)*, June 12-16, New Orleans, LA USA.

18. **Kong, R.,** Kim, S., Experiments in Horizontal Bubbly-to-Plug and Bubbly-to-Slug Transition Two-phase Flow, *Proceedings of 2015 American Nuclear Society Winter Meeting*, November 8-12, Washington, DC USA.

19. **Kong, R.,** Kim, S., Characterization of Horizontal Air-water Two-phase Flow, *Proceedings of 2015 16th International Meetings on Nuclear Reactor Thermal Hydraulics (NURETH-16)*, August 30-September 4, Chicago, IL USA.

20. Worosz, T., Bernard, M., **Kong, R.,** Toptan, A., Kim, S., Sensitivity Studies on the Multi-Sensor Conductivity Probe Measurement Technique for Two-phase Flows, *Proceeding of 2015 US-Japan Seminar on Two-phase Flow Dynamics*, May 10-15, West Lafayette, IN USA.

21. **Kong, R.,** Kim, S., Four-sensor Conductivity Probe Sensitivity Study on Bubble Velocity Measurement, *Proceedings of 2014 American Nuclear Society Students Conference*, April 3-6, State College, PA USA.

Reports:

1. Kim, S., Ishii, M., **Kong, R.,** Final Report on Jet Impingement Model Evaluation in High-Energy Piping Systems, *PU/NE-19-05*, Purdue University, 2019.

2. Kim, S., **Kong, R.,** Bian, J., Ryan, D., Dix, A., Design Report of the Purdue Inclined Two-Phase Air-Water (PITA) Test Facility, *PU/NE-19-04*, Purdue University, 2019.

3. Kim, S., Ishii, M., **Kong, R.,** Final Literature Review Report on Jet Impingement in High-Energy Piping Systems, *PU/NE-19-02*, Purdue University, 2019.

4. Kim, S., **Kong, R.,** Final Report on Experiments on Scalability of Horizontal Two-Phase Flow in Small (38.1 mm) and Large (101.6 mm) Diameter Pipes, *PU/NE-18-04*, *Purdue University*, 2018.

5. Kim, S., **Kong, R.,** Pham, H., Larimer, J., Design Report of a Large Diameter (101.60 mm I.D.) Horizontal Air-Water Two-Phase Flow Test Facility, *PSU-MNE/AMFL-16-01*, *The Pennsylvania State University*, 2016.

Theses:

1. **Kong, R.,** Characterization of Horizontal Air-Water Two-Phase Flow in Different Pipe Sizes, *PhD Dissertation in Nuclear Engineering, School of Nuclear Engineering, Purdue University*, 2018.

2. **Kong, R.,** Establishment and Application of the Thermal Hydraulic Behavior and Accident Analysis of Spent Fuel Pool for Nuclear Power Plants, *Master Thesis in Nuclear Engineering, School of Mechanical Engineering, Shanghai Jiao Tong University*, 2013.

Invited Seminars:

1. "Advances in Two-Phase Flow Research to Improve Safety Analysis of Nuclear Power System" Oak Ridge National Laboratory, December 4, 2018.

Synergistic Activities

Reviewer for Journals

Experimental Thermal and Fluid Science (ETFS);
Flow, Turbulence and Combustion;
International Journal of Heat and Mass Transfer (IJHMT);
International Journal of Multiphase Flow (IJMF);
International Journal of Energy Research (IJER);
Nuclear Engineering and Design (NED);
Nuclear Engineering and Technology (NET);
Nuclear Technology (NT);
Progress in Nuclear Energy (PNUCENE);

Reviewer for Conferences

ANS Annual/Winter Meeting;
2020 International Conference on Nuclear Engineering (ICONE-28)
2019 International Meetings on Nuclear Reactor Thermal Hydraulics (NURETH-18);
2018 International Congress on Advances in Nuclear Power Plants (ICAPP-18);
2018 International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Operation and Safety (NUTHOS-12);
2018 International Topical Meeting on Advances in Thermal Hydraulics (ATH-2018)

Technical Session Chair for

ANS Annual/Winter Meeting;
2019 18th International Meetings on Nuclear Reactor Thermal Hydraulics (NURETH-18)

Professional Affiliations

American Nuclear Society (ANS);
American Society of Mechanical Engineers (ASME)

Honors and Awards

Outstanding Graduate of Shanghai Jiao Tong University, 2013
Guanghua Educational Scholarship, Shanghai Jiao Tong University, 2011
Academic Scholarship of Shanghai Jiao Tong University, 2011
Outstanding Student Scholarship, Shandong University, 2006, 2007, 2008