NUSAIR M. HASAN

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Research Interests

Process optimization of thermal (cryogenic) systems, cryogenic heat exchangers, multi-phase flow and heat transfer, cryogenic purification, thermoacoustic transport phenomena.

PROFESSIONAL EXPERIENCE

July 2018 – Present

Cryogenics Staff Engineer, Facility for Rare Isotope Beams, Michigan State University, East Lansing, MI

- Leading, performing, participating and assisting university under-graduates, graduates and postdoctorates, and assigned junior staff members in the areas including cryogenic system mechanical design, helium system processes, instrumentation, safety issues pertaining to helium cryogenic systems, standard equipment-system specification development, and cost estimation model development.
- Designing cryogenic process and safety systems for superconducting magnets and cryo-modules utilized in particle accelerators.
- Process design lead for developing the cryogenic distribution system for FRIB's target, pre-separator segment and A1900 fragment separator superconducting magnets.
- Developing commissioning and performance test plans associated with FRIB cryogenic equipment supported by the department, *e.g.*, cryogenic plant, cryogenic transfer lines, and cryo-module.
- Developing maintenance, improvement, upgrade strategies, and procedures; including deployment and testing of applicable R&D.

October 2014 – June 2018

Cryogenics Process Engineer, Jefferson Lab, Newport News, VA

- Process engineering support for design/development of large scale 2 K and 4.5 K helium refrigeration systems, cryostats, and cryogenic systems at Jefferson Lab and several other US-DOE user facilities.
- Lead Process Engineer for sub-atmospheric cold box replacement and Experimental Systems refrigerator upgrade projects. Developed technical requirements for key equipment (cold compressors, heat exchangers etc.) and aiding as the SOTR for the procurement of these equipment.
- Served as a key member of the 12 GeV upgrade cryogenic system re-commissioning team. Aided in characterization and performance mapping of the 12 GeV upgrade cryogenic refrigeration system.
- Lead teams of junior engineers and technicians for commissioning and acceptance testing of several cryogenic system components, such as 750W cold box at Cryogenic Test Facility (CTF), stand-by warm helium compressor for 12 GeV upgrade, CHL recovery compressors etc.
- Provided cryogenic process related support (analysis, component selection and procedure development) to several inter-departmental projects/activities on a regular basis; such as SLAC LSLCII cryo-module commissioning at CTF, UITF cryo-module commissioning, LERF cryomodule test bench development, CEBAF gradient improvement etc.

September 2010 – September 2014

Graduate Research Assistant, Drexel University, Philadelphia, PA

- Advanced research and training focused towards characterizing thermally and acoustically driven transport in near-critical supercritical fluids.
- Mentoring undergraduate design teams working in the area of thermoacoustic transport and pulse tube cryo-cooler performance improvement.

ADVISING / TEACHING EXPERIENCE

July 2018 – Present

Academic Staff, <u>Facility for Rare Isotope Beams</u>, <u>Michigan State University</u>, <u>East Lansing</u>, <u>MI</u> *Courses Taught:*

Mechanical Design of Cryogenic Systems (ME 414) – Fall 2018-19, Fall 2019-20, Fall 2020-21 Cryogenic Thermal Systems (ME 413) – Spring 2018-19, Spring 2019-20, Spring 2020-21 Exergy Analysis of Thermal Systems (ME 891) – Summer 2019-20 *Research Advising:* Duncan Kroll (MSc, 2020) – Development of the Mechanical Design of a Freeze-out Purifier Duncan Kroll (PhD, Ongoing) – Process Optimization for Freeze Purification of Helium

September 2010 – August 2014

Teaching Assistant, Drexel University, Philadelphia, PA

Courses Taught: Heat Transfer (MEM 345), Thermal Systems Analysis (MEM 440), Introduction to Thermodynamics (ENGR 210), Thermodynamic Analysis I (MEM 310), Evaluation and Presentation of Experimental Data I (ENGR 201), Foundations of Fluid Mechanics (MEM 621).

February 2008 – August 2010

Lecturer, <u>Bangladesh Univ. of Engineering and Technology</u>, <u>Dhaka</u>, <u>Bangladesh</u> *Courses Taught*: Engineering Numerical Analysis, Solid Mechanics, Heat Engine Laboratory, Thermal

and Fluid Sciences Laboratory.

EDUCATION

<i>Ph.D., Mechanical Engineering</i> Drexel University, Philadelphia, PA	2014
Master of Science, Mechanical Engineering Bangladesh University of Engineering and Technology, Dhaka, Bangladesh	2010
Bachelor of Science (Summa cum laude), Mechanical Engineering Bangladesh University of Engineering and Technology, Dhaka, Bangladesh	2008

HONORS / AWARDS

- Doctoral Research Excellence 'Highly Commended' citation, Drexel University, 2014
- George Hill, Jr. Endowed Fellowship, Drexel University 2014
- Drexel University College of Engineering Dean's Fellowship, 2010
- V.G. Desa Award, Bangladesh Univ. of Engineering and Technology, 2007

PROFESSIONAL SERVICES AND ACTIVITIES

Reviewer Service

- US-DOE Office of High Energy Physics, SBIR Proposals.
- ASME 2017 Summer Heat Transfer Conference
- ASME 2016 Summer Heat Transfer Conference
- The Journal of Supercritical Fluids
- ASME 2012 International Mechanical Engineering Congress & Exposition
- ASME 2012 Summer Heat Transfer Conference

Professional Memberships

Cryogenic Society of America

LIST OF PUBLICATIONS / PRESENTATIONS

Peer-Reviewed Journal Articles:

- 1. Howard, J, <u>Hasan, N.</u>, Knudsen, P., Thermal-hydraulic characterization of shell-side flow in a cryogenic coiled finned-tube heat exchanger, 2020, *ASME Journal of Heat Transfer*, v. 143
- 2. Farouk, B., Antao, D. and <u>Hasan, N.</u>, "Acoustically driven oscillatory flow fields in a cylindrical resonator at resonance", 2019, *Journal of the Acoustical Society of America*, v. 145
- 3. Farouk, B. and <u>Hasan, N.</u>, "Trans-critical Carbon Dioxide Flow in a Heat Exchanger: Applications in Waste Heat Recovery", 2016, *Journal of Computational Heat Transfer*, v. 8(4)
- 4. <u>Hasan, N.</u> and Farouk, B., "Experimental and Numerical Investigations of Resonant Acoustic Waves in Near-Critical CO₂", 2015, *Journal of the Acoustical Society of America*, v. 138
- 5. Farouk, B. and <u>Hasan, N.</u>, "Acoustic Wave Generation in Near-Critical Supercritical Fluids: Effects on Mass Transfer and Extraction", 2015, *Journal of Supercritical Fluids*, v. 96
- 6. <u>Hasan, N.</u>, Antao, D. and Farouk, B., "DC Negative Corona Discharge in Atmospheric Pressure Helium: Transition from the Corona to the 'Normal' Glow Regime", 2014, *Plasma Sources Science and Technology*, v. 23
- 7. <u>Hasan, N.</u> and Farouk, B., "Fast Heating Induced Thermoacoustic Waves in Supercritical Fluids: Experimental and Numerical Studies", 2013, *Journal of Heat Transfer*, v. 135
- 8. <u>Hasan, N.</u> and Farouk, B., "Mass Transfer Enhancement in Supercritical Fluid Extraction by Acoustic Excitations", 2013, *Journal of Supercritical Fluids*, v. 80
- 9. <u>Hasan, N.</u> and Farouk, B. "Buoyancy Driven Convection in Near-Critical and Supercritical Fluids", 2012, *International Journal of Heat and Mass Transfer*, v. 55
- 10. <u>Hasan, N.</u> and Farouk, B. "Thermoacoustic Transport in Supercritical Fluids at Near-critical and Near-pseudo-critical States", 2012, *Journal of Supercritical Fluids*, v. 68

Selected Conference Publications and Presentations:

- 1. <u>Hasan, N.</u>, Wright, M., *et al.*, Design, Fabrication, and Installation of the Cryogenic Distribution System for FRIB Target and Fragment Pre-Separator Superconducting Magnets, 2021, *Cryogenic Engineering Conference and International Cryogenic Materials Conference (Online)*
- <u>Hasan, N.</u>, Ganni, V., *et al.*, Design of Cryogenic Heat Exchangers and associated Sub-Systems for Controlled Cool-down and Testing of Superconducting Magnets at FRIB, 2021, *Cryogenic Engineering Conference and International Cryogenic Materials Conference (Online)*
- 3. Kroll, D., <u>Hasan, N.</u>, Ganni, V., "Freeze-Out Purifier for Helium Refrigeration System Applications", 2019, *Cryogenic Engineering Conference and International Cryogenic Materials Conference, Hartford, CT.*

- 4. Knudsen, P., Ganni, V., <u>Hasan, N.</u>, Wright, M., Casagrande, F., Vargas, G., Joseph, N., "FRIB Helium Refrigeration System Commissioning and Performance Test Results", 2019, *Cryogenic Engineering Conference and International Cryogenic Materials Conference, Hartford, CT.*
- 5. <u>Hasan, N.</u>, Knudsen, P. and Ganni, V., "Applicability of ASST-A helium refrigeration system for JLab End Station Refrigerator", 2017, *IOP Conf. Ser.: Mater. Sci. Eng.* 278 012114
- 6. <u>Hasan, N.</u>, Knudsen, P. and Wright, M., "Online helium inventory monitoring of JLab cryogenic systems", 2017, *IOP Conf. Ser.: Mater. Sci. Eng.* 278 012113
- Wijeratne, T., <u>Hasan, N.</u>, Wright, M., Ganni, V., Dixon, K., Creel, J., and Knudsen, P., "Commissioning and Testing of a new 4.5K Cold Box for JLab Cryogenic Test Facility", 2017, *IOP Conf. Ser.: Mater. Sci. Eng.* 278 012094
- Knudsen, P., Ganni, V., <u>Hasan, N.</u>, Dixon, K., Norton, R. and Creel, J., "Mod. to JLab 12 GeV Refrigerator and Wide Range Mix Mode Performance Testing Results", 2017, *IOP Conf. Ser.: Mater. Sci. Eng.* 171 012015
- 9. <u>Hasan, N.</u> and Farouk, B., "Acoustically Augmented Flow and Transport in Supercritical Fluids", ASME 2013 International Mechanical Engineering Congress & Exposition, November 15-21, 2013
- 10. <u>Hasan, N.</u> and Farouk, B., "Enhancing Supercritical Fluid Extraction using Acoustic Excitations", ASME 2012 International Mechanical Engineering Congress & Exposition, November 9-15, 2012