



IIHCC

Solving problems that exist at, and along, the interdependencies between humans, community, and infrastructure to ultimately improve quality of life.

Summer Edition

August 2020

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Awardees for 2020-2021 IIHCC Grants
Jeremy Tidman appointed new GRA Project Analyst

Calendar

8/24 | University Classes Begin
8/28 | [First Fall ICAT Virtual Playdate](#)
9/04 | [Virtual Gobblerfest](#)

If you have any questions, comments, or concerns, please contact us:

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For more information about IIHCC, [visit our website](#)

CLUSTER HIRE SPOTLIGHT



Juliana Duarte

Assistant Professor

Department of Mechanical Engineering

PhD, Nuclear Engineering and Engineering Physics | *University of Wisconsin-Madison*

MS, Electrical Engineering | *University of Sao Paulo*

BS, Nuclear Engineering | *Federal University of Rio de Janeiro*

BS, Physics | *State University of Campinas*

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How do you see your work contributing to the goals and vision of IIHCC?

IIHCC's vision is focused on human-centered communities, and energy is an integral part of daily life. For a better community, the energy used must be economic, safe, reliable, and sustainable—not only for this generation but also for future generations. I applied to work for Virginia Tech because I was interested in the university's likeminded approach to research as a means to improve society and community. Nuclear energy plays an important role in providing a capable and reliable energy source for today and the future societies. However, there are still challenges associated with the long-term storage of nuclear waste. For example, my latest proposal researches the topic of the spent nuclear fuel (SNF) dry cask system and the steps that may be taken for a long-term use of these casks. When this system was implemented decades ago, they were designed to ensure integrity for years to come, but now we are interested to further investigate the effects of this system, and if there are better solutions.

What other areas outside of your discipline would you entertain for future research and proposal work?

As of now, I do have a research group comprised of engineers from different fields and physicists who work together. This research group is unique in that because of our different fields and backgrounds in engineering and science, we are able to provide our own perspective and expertise when confronting a new challenge. I am also interested to continue my work with researchers with political science and policy decision-making. In my recent proposal [Investigation of Spent Nuclear Fuel (SNF) Dry Cask System for Long-Term Storage] for the IIHCC call for grant proposals, I worked with Sonja Schmid, Associate Professor in the Department of Science, Technology and Society (STS). We come from two different backgrounds (engineering and policy), but we are working towards the same goal of proper and effective nuclear energy usage. Together, we wish to explore areas like risk assessment so that new nuclear energy policy and regulation for nuclear energy is ethically sound and based on intergenerational equity.

Juliana Duarte's research was featured in a VT News article on August 18, 2020. See the article [here](#).

Nuclear Safety
Analysis

Thermal-
Hydraulic
Systems

Two-phase
Flow

Advanced Light
Water Reactors

Small Modular
Reactors

CLUSTER HIRE SPOTLIGHT



Ali Mehrizi-Sani

Associate Professor

The Bradley Department of Electrical and Computer Engineering

PhD, Electrical Engineering | *University of Toronto*

MS, Electrical Engineering | *University of Manitoba*

BS, Electrical Engineering | *Sharif University of Technology*

BS, Petroleum Engineering | *Sharif University of Technology*

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How do you see your work contributing to the goals and vision of IIHCC?

The power system is a critical infrastructure. Many, if not all, aspects of modern life require electrical energy to operate; some examples are manufacturing (think lighting and automatic welding machines), transportation (think pumps and the subway system), and education (think AV technology and online lectures we all are doing during the COVID-19 pandemic). Therefore, my work's goal on making the power system more resilient, reliable, secure, efficient, and sustainable directly relates to the IIHCC's vision to further the infrastructure related to energy, health, and environment for the betterment of the life of people. I specifically contribute to achieving these goals through making the power system more flexible through integration of inverter-based renewables and making it more secure through implementation of cybersecurity measures.

What other areas outside of your discipline would you entertain for future research and proposal work?

The power system is the largest man-made machine and an extremely ubiquitous technology. As a cyber-physical system, the power system, produces large volumes of data by devices such as phasor measurement units (PMU; invented at Virginia Tech in 1980s) and smart inverters utilized for renewables. These data are collected via an expansive communication network. 5G is the new generation of communication networks, which can enable several applications for the power system that are yet unexplored because of the speed, reliability, and latency limitations of the existing technology. Ensuring timely delivery of data brings about the concept of information freshness—a measure of the age (and hence, relevance and confidence) of the information. Studying the impact of information freshness (called age of information or AoI), especially within the context of 5G communication networks, on the power grid is an area of research I am interested in exploring.

Another example work is improving the quality of life for people impacted by disasters by providing reliable renewables-based (solar photovoltaics) electricity in structurally flexible shelters, which will also use electrical energy to adaptively respond to the psychological needs of the occupants. The core idea is not limited to emergency shelters and can also be used as a permanent housing solution with smart features. Ultimately, our goal will again be to improve mental health and wellbeing of the people, within the context of smart cities and communities and while being cognizant of their technology acceptance.

Renewables
Grid Integration

inverter-Based
Resources

Cybersecurity
for Inverters

Machine
Learning for
Control

Microgrids

AWARDEES OF THE IIHCC GRANTS 2020-2021

Following the review of IIHCC grant proposals, three were selected for funding:

A Clinical and Social Adoption Study of Frailty Diagnosis through Passive, In-Situ Gait Monitoring

Principal Investigator | **Rodrigo Sarlo, COE** *Co-Principal Investigator* | **Tiffany Drape, CALS**

Team Members | **Joseph Scarpa, Jr, Sriram Malladik** *Senior Personnel* | **Robin Queen**

The objective of this study is to assess the long-term adoption potential of two passive, in-situ gait monitoring methods for screening potentially frail patients, a majority of whom are older adults. The potential will be assessed along two dimensions: clinical utility (does the sensor-based gait information provide a tangible value to healthcare professionals?) and social acceptability (what non-technical aspects of the technologies make them attractive or unattractive for personal use?). The outputs of this project will be 1) a deployable gait monitoring approach which maximizes clinical utility and 2) a preliminary framework for assessing the adoption potential passive gait monitoring systems.

Investigation of Spent Nuclear Fuel (SNF) Dry Cask System for Long-Term Storage

Principal Investigator | **Juliana Duarte, COE** *Co-Principal Investigators* | **Rebecca Cai, COE and Sonja Schmid, CLAHS**

The goal of this one-year research project will be centered around the challenges associated with the use of Dry Storage Cask (DSC) system for the long-term storage of Spent Nuclear Fuel (SNF). The technological challenge focus on the thermal and dust accumulation modeling of DSC using three-dimensional Multiphysics computational fluid dynamics. Our goal is to find the combination of parameters that leads to the development of chloride-induced stress corrosion cracking (CISCC) and possibly cracking of the containment boundary that houses the SNF.

CYBORGS: Compassionate deplOyable spaces using Biosignals of Occupants for disaster Relief and Grid Service

Principal Investigator | **Ali Mehrizi-Sani, COE** *Co-Principal Investigator* | **Kereshmeh Afsari, CAUS**

The central idea of this project is to provide high-quality housing units that adapt based on the psychological needs of their occupants (i.e., people affected by disasters and beyond) to improve their mental health. Of particular interest to us is to minimize the displacement of the affected population from their homes—a factor recognized to aid in recovery and reduce mental health complications.

We thank our peers who served as application reviewers:

Kereshmeh Afsari, Edward Becker, Maggie Cowell, Brandy Faulkner, Kevin Heaslip, Eunju Hwang, Myounghoon Philart Jeon, and Yuhao Zhang,

JEREMY TIDMAN: IIHCC PROJECT ANALYST



IIHCC welcomes our newly hired GRA for IIHCC, Jeremy Tidman. He will be taking over Jordan Erisman's Project Analyst position to assist with operations of our DA. Jeremy is a second year M.A. student in the department of Material Culture and Public Humanities following completion of his B.A. at Virginia Tech in Religion and Culture. Public humanities, social change, and human-centered community projects rest at the heart of Jeremy's research topics, as he seeks to discover the most effective methods of ensuring that the effects and results of those projects outlast the established end date. This aligns closely with the mission and values of IIHCC, and he hopes to be able to offer a fresh and unique perspective from which to approach the challenges and aspirations of IIHCC. Jeremy expresses tremendous excitement and gratitude to the IIHCC community for granting him the opportunity to work with the team and looks forward to helping overcome the challenges presented by the ever fluid circumstances we all face this year.