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One Health Modelling Network for Emerging Infections | Réseau une seule santé sur la modélisation des infections

OMNI-REUNIS Super-Spreader Seminar Series

These seminar series is intended to provide faculty members, OMNI-RÉUNIS affiliates and HQPs a platform to present their research, share experiences and foster collaboration among OMNI-RÉUNIS, the Emerging Infectious Disease Modelling (EIDM) networks, and the scientific community.

TITLE: MINIMIZING AIRBORNE TRANSMISSION ROUTES IN INDOOR PUBLIC SPACES USING A COMBINED SPATIO-TEMPORAL RISK MODEL AND COMPUTATIONAL FLUID DYNAMICS APPROACHES

Zoom (Virtual Seminar) | Thursday, Oct 19, 2023 | 11:00 am-12:00 pm EDT

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MEET THE PRESENTER

DR. MARINA FREIRE-GORMALY

Marina Freire-Gormaly, PhD, is an Assistant Professor in Mechanical Engineering Department at the Lassonde School of Engineering at York University. Her research focusses on the development of an improved understanding of aerosol transmission in indoor environments considering the HVAC design, the development of stand-alone solar powered reverse osmosis water treatment systems and energy recovery systems for remote communities that lack access to grid electricity. She also is interested in machine learning applications for smart design of innovative energy and water systems. Her research interests are also in advanced manufacturing, smart systems using Internet of Things & artificial intelligence, and advanced additive manufacturing methods. She completed her Ph.D. and M.A.Sc. from the University of Toronto in Mechanical Engineering. Her M.A.Sc. was on pore space characterization of carbonate rocks using micro computed tomography and pore network modeling for advancing Carbon Capture and Storage Technology. She has previously been a course instructor for undergraduate energy related engineering courses at the University of Toronto.She has also worked at Ontario Power Generation (OPG) on the Darlington New Nuclear Project and the Darlington Refurbishment Project. She contributed to a World Bank project evaluating Canada's 'Regulatory Indicators for Sustainable Energy' (RISE). She currently serves as the Chair of Student and Young Professional Affairs for the Canadian Society of Mechanical Engineers (CSME). She is passionate about research and teaching energy systems to inspire the next generation of engineers to tackle society's growing sustainability challenges. Her research interests include energy systems, optimization and design for global engineering contexts.

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SEMINAR TITLE AND ABSTRACT

MINIMIZING AIRBORNE TRANSMISSION ROUTES IN INDOOR PUBLIC SPACES USING A COMBINED SPATIO-TEMPORAL RISK MODEL AND COMPUTATIONAL FLUID DYNAMICS APPROACHES.

The goal of the research project is to minimize the risk of the spread of airborne diseases in indoor environments considering the HVAC (Heating Ventilation and Air Conditioning design. We characterize the spread of droplets and aerosols from an average human cough using Computational Fluid Dynamics. The purpose of studying cough flow dynamics is to predict and minimize airborne transmission routes for viruses such as the current SARS-CoV-2, its variants, and other airborne diseases. Viral particles primarily spread through infected patients' droplets and aerosols, released from coughing, sneezing, talking and other exhalatory actions, leading to airborne transmission. Airborne transmission can especially be exacerbated in indoor spaces, where proper ventilation and filtration measures are not taken, causing large scale contagions. This calls for a tested methodology to predict air flow routes and cough droplet spreading capabilities in various spaces. A numerical analysis using ANSYS Fluent 2019 is used to compute various spread parameters. The simulation is initialized as a transient, turbulent flow with an injection of water particles at an initial velocity, inlet diameter, spread angle among other parameters at varying ambient conditions. Sensitivity analysis for various turbulent models and solver settings will assist in validating the numerical model, as well as future experimental comparisons. The research will continue in the longer term with plans to integrate machine learning to develop a system capable of predicting and suggesting air flow optimization methods to minimize airborne transmission pathways. These findings will assist in making indoor spaces safer and providing more passive defense measures against viral pandemics.

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