Emergent Research:

The PIMS Postdoctoral Fellow Seminar

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From Liquid Fuel Injection to Blood Flow in Human Body

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ABSTRACT:

With the advancement in the high performance computing (HPC), it has become feasible to simulate various physical processes and phenomena. Such processes have applications ranging from energy & transportation sector to biological research. The process of liquid fuel injection and atomization forming fuel drops in aircraft engines is central to the formation of pollutants, therefore, it is crucial to study and control this process. The atomization is a physical process in which bulk liquid breaks up into small drops, further breaking up into even smaller drops finally leading to their evaporation. Quite often these drops are studied in an Eulerian fashion. Another approach to investigate the drops or deformable capsules is in a Lagrangian fashion. In this approach, each drop/capsule is tracked separately and is assumed to be either a rigid sphere or a deformable thin membrane. The latter has the direct application to the investigations of red blood cells (RBC) in biological systems. In fact, a RBC has a visco-hyperelastic thin membrane rendering it to be transported through capillary blood vessels of two times smaller its own size. By studying the dynamics of deformation of this membrane, it is possible to extract vital mechanical properties and develop a generalizable numerical model. This model has the potential to be employed to predict blocks in blood vessel the knowledge of which is helpful in improving the measurement of blood pressure. In this talk, I will be presenting two accurate, efficient, and robust numerical methods for simulating liquid fuel atomization process along with showcasing their engineering applications for subsonic & supersonic aircrafts. Furthermore, I will be giving a brief introduction to my current research work on the development of a numerical membrane model (NMM) for studying RBC deformation dynamics.

SPEAKER BIO:

Anirudh Asuri Mukundan obtained his Ph.D. from the Université de Rouen Normandie in Rouen, France on the topic of numerical modeling of liquid fuel atomization in aircraft engines under the supervision of Dr. Alain Berlemont, Dr. Thibaut Ménard, and Dr. Jorge César Brändle de Motta. His Ph.D. was funded by the European Union's Marie Skłodowska-Curie Early Stage Researcher (ESR) Fellowship. During his PhD, he collaborated with Dr. Ruud Eggels from Rolls-Royce Deutschland and Prof. Marcus Herrmann at the Arizona State University on the topic of liquid fuel injection for subsonic and supersonic aircrafts. He completed his Master's degree in Computational Engineering Science at the RWTH Aachen University during which time, he was mentored by Prof. Heinz Pitsch on the topics of liquid atomization and combustion. He completed Bachelor of Technology degree in Industrial Engineering at the National Institute of Technology (NIT) Tiruchirappalli in Tiruchirappalli, India. Currently, he is a PIMS-CNRS Postdoctoral Research Fellow at the Department of Mathematics in the University of British Columbia working with Prof. Anthony Wachs on the topic of numerical modeling of red blood cells (RBC).

For more information and registration:
https://www.pims.math.ca/seminars/PIMSPDF

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PIMS ongoing lecture series featuring our Postdoctoral Fellows every three weeks. You will have the opportunity to connect with emerging research in the mathematical sciences from a PIMS Postdoctoral Fellow. PIMS PDFs are amongst the top young researchers in Canada, and this is an excellent opportunity to learn about them, and their work.