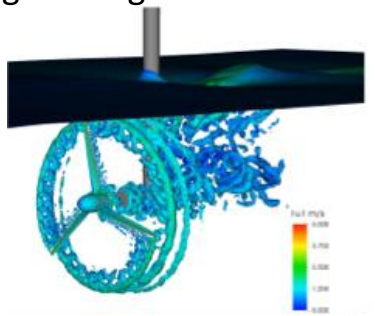
筑波大学
University of Tsukuba

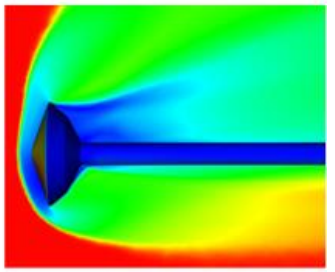
# *EME International Seminar Series*

## Recent Advances in Finite-Element-Based Stabilized and Multiscale Methods: from Marine Renewable Energy Systems to Hypersonic Flows in Thermo-Chemical Non-Equilibrium

**Prof. Artem Korobenko**

Associate Professor
Department of Mechanical and Manufacturing Engineering
University of Calgary, Canada





## Abstract:

In this talk, recent developments in stabilized and variational multiscale (VMS) methods for fluid mechanics utilizing finite-element discretization will be presented. Both incompressible and compressible flow problems will be discussed. The numerical framework, developed by the CFSMgroup at the University of Calgary (https://www.cfsmgroup.com/), solves the Navier-Stokes equations. For compressible flows, a two-temperature model for non-ionized reacting flows in thermochemical non-equilibrium is employed. The equations are solved using the pressure-primitive set of variables, combined with a residual-based shock capturing operator and the Streamline-Upwind Petrov–Galerkin (SUPG) stabilization techniques. For incompressible flows, the Navier-Stokes equations are coupled with a transport equation for vapor/volume fraction for multiphase flows. The VMS method is adopted for turbulence modeling, operating as an LES-like approach and eliminating the need for filters or artificial dissipation. The applications presented include vertical-axis hydrokinetic turbines in turbulent flow with free surfaces, cavitating flow simulations, double-cone and hollow cylinder extended flare configurations, and re-entry vehicles.

Monday, June 30, 2025
14:00 – 15:00 (JST) @ 3E301 (onsite only)

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http://www.eme.tsukuba.ac.jp/en/

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## Bio:

Dr. Artem Korobenko is an Associate Professor and Associate Head, Research at the Department of Mechanical and Manufacturing Engineering at the University of Calgary (Canada). He holds a Schulich Research Chair and leads the Computational Fluids and Structural Mechanics Group (CFSMgroup). Dr. Korobenko earned his PhD in 2014, followed by a postdoctoral position (2016), both at the University of California San Diego. His research focuses on the development of multi-fidelity computational methods for the analysis and design of complex systems in aerospace, wind and marine engineering using large-scale computing. A Fulbright Alumni and Alexander von Humboldt Fellowship recipient, Dr. Korobenko is a founding member and current president of the Canadian Association for Computational Science and Engineering, as well as a Member-at-Large of the USACM Technical Thrust Area on Computational Fluid Dynamics and Fluid-Structure Interaction. He is also a founding member and co-director of the University of Calgary Aerospace Network.

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