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Multi-fidelity modeling framework for wind energy applications based on ALM-VMS formulation for stratified flows

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Abstract

In this seminar a high-fidelity numerical framework for wind energy applications developed by the CFSMgroup at the University of Calgary (https://www.cfsmgroup.com/) will be discussed. The framework is based on the variational multiscale (VMS) formulation for fluid mechanics and uses the incompressible Navier-Stokes equations along with a transport equation for temperature. The formulation uses either linear finite-elements or quadratic NURBS for spatial discretization. The formulation is further coupled with the Actuator Line Method (ALM) to reduce the computational cost when modeling wind turbine rotors. The stability and accuracy of the numerical formulation near the wall is enhanced through the weak imposition of the boundary conditions, which shares similarities with classical wall modeling approach. The accuracy and robustness of the framework will be demonstrated on various examples, including but not limited to multiple wind turbines simulation under the stable atmospheric boundary layer flow, wind farm simulation, flow over the complex terrains, and other examples

Biography

Dr. Artem Korobenko is an Associate Professor in the Department of Mechanical and Manufacturing Engineering at the University of Calgary where he leads the Computational Fluids and Structural Mechanics Group (CFSMgroup). His research focuses on the development of high-fidelity multidisciplinary methods for the analysis and design of complex systems in aerospace, wind and marine engineering using large-scale computing. He actively collaborates with industries, governmental agencies, and academic institutions worldwide. Dr. Korobenko is a recipient of the Fulbright Scholarship and most recently Alexander von Humboldt Fellowship for Experienced Researchers. He is a founding member and vice-president of the Canadian Association for Computational Science and Engineering and Member-at-Large of the USACM TTA on Computational Fluid Dynamics and Fluid-Structure Interaction. He is also a founding member and co-director of the University of Calgary Aerospace Network and the main organizer and the conference chair for the 16th World Congress on Computational Mechanics which will be held in 2024 in Vancouver, Canada

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