Dr. Seiya Watanabe

Dr. Seiya Watanabe is an assistant professor at Research Institute for Applied Mechanics (RIAM), Kyushu University, Japan. He received his B.S. in mechanical engineering from Gunma National College of Technology, M.S. in energy science from Tokyo Institute of Technology, and Ph.D. degree in mechanical engineering from Tokyo Institute of Technology in Japan. After his Ph.D. study, he worked as an appointment researcher at Global Scientific Information and Computing Center in Tokyo Institute of Technology. He started to work for RIAM from January 2020. His current research interests include ocean renewable energy technologies, computational fluid dynamics by lattice Boltzmann method, and high-performance computing.

Keynote Presentation 3:
Lattice Boltzmann Simulation Using Actuator Line Model for Tidal Current Turbines

In numerical simulations of tidal current power generation farms, large-scale CFD simulations with a high-resolution grid are required to calculate the interactions between tidal turbine wakes. In this study, we develop a numerical simulation method for tidal current turbines using the lattice Boltzmann method (LBM), which is suitable for large-scale CFD simulations. Turbines are modeled using the actuator line model (ACL), which represents each blade as a point cloud. In order to validate our LBM-ACL model, we simulate the NREL-5MW turbine, which has been analyzed and tested in many previous studies, and LBM-ACL simulation results are in good agreement with an NS-ACL simulation. We conducted a water tank experiment with two turbines and confirmed that LBM simulations could reproduce the experiment in terms of wake interaction and wave effects on turbine performance. Our LBM-ACL code can run a large-scale LES with 1.48 billion grid points for a tidal current power farm using the multi-GPU system ITO subsystem B at Kyushu University.