

Division of Environmental Studies

Department of Ocean Technology, Policy and Environment

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Takagi Laborator	Prof. Ken TAKAGI	<p>Takagi Lab aims at enhancing ocean technologies which could overcome big issues of mankind such as depletion of natural resources, food crisis and global warming. For this purpose, we are conducting several marine projects and trying to identify key technologies in each project. Now, we focus on the ocean current turbine system, which convert ocean current energy to electricity. So far, we formed a consortium with several private companies, and developed a prototype floating current turbine which was tested last year. We are also interested in other offshore technologies and expanding the research field such as marine drones, floating systems and riser systems. These technologies are expected to be applied for offshore oil & gas development in developing countries and the construction of wind farm in Japan. It is noted that our final goal is not only to develop new technologies but also to make proposals for ocean technology policy in comprehensive and systematic fashion based on findings in these research projects.</p>	<p>Ocean renewable energy; Offshore technology; Oceanic engineering; Marine technology</p>	<p>We are developing a floating type ocean current turbine system as stated above. The full scale device is planned to have two big turbines whose diameter is about 40m for the 2MW system. We have done a demonstration of a 100kW prototype model in water of off Kuchinoshima Island. However, we still have many concerns. Major concerns to commercialize the proposed system is whether the system is safe, reliable and low cost or not in realistic ocean current which contains turbulence, wave effect. To give an answer, we have conducted an ocean current measurement at sea as well as a numerical simulation of ocean current. On the other hand, we developed a simulator of the current turbine system. Combining measurement data and the simulator, we are tackling above mentioned concerns. Summer program students can participate elementary researches which have wide spectrum from analysis of the real sea data to the simulation of the device controlling system. Details of the research theme will be decided after consulting with the supervisor according to the knowledge and ability of the candidate. However, it is preferable if program students have knowledge of fluid dynamics and/or dynamics of rigid bodies.</p>

<p>Waseda Laboratory</p>	<p>Prof. Takuji WASEDA</p>	<p>The following research activities are on-going: i) waves in the ice-covered sea; ii) freak waves under storm; iii) Stereo-imaging of ocean waves; iv) high-resolution coastal wave, current and wind modeling and observation for assisting marine sports. In the first project, we are extensively studying wave-ice interaction in the Arctic Ocean. Wave buoys were deployed in 2016 and also in 2019. Historical and future events are studied as well. In the second project, numerical simulations of waves under typhoon and bomb cyclone are conducted to identify dangerous seas where the freak wave occurrence is high. In the third project, a field observation is conducted using stereo photogrammetry from an ocean tower to reconstruct 3D surface wave geometry. We plan to extend this method to be used on board the ship. In the fourth project, aiming for the 2020 Olympic game, we are constructing a data base for the sailing competition. The overall activities in our group encompasses theoretical, observational and numerical studies of ocean waves, currents and wind. The acquired knowledge will be applied to the developments of the Northern Sea Route, safe navigation and operation at sea, and marine renewable energy.</p>	<p>Ocean waves; freak wave; marine wind; marine renewable energy; stereo photogrammetry</p>	<p>The student will engage him/herself in a self-motivated research project that includes but is not restricted to the research topics listed above. The research may involve analyses of ocean satellite image, observation data and model outputs. Those motivated can challenge in programming the numerical model and analysis program as well. The research will be guided by postdoctoral researchers, graduate students, Assistant Prof. Kodaira and Prof. Waseda. Regular meetings will be held in English. The past UTSIP students undertook the following research topics: developing phase resolved nonlinear wave model based on High-Order Spectral Method; Synthetic Aperture Radar image analysis for ocean waves; assessment of wave power considering the performance of Wave Energy Converter; optimization of sail assisted ship navigation; freak wave occurrence near Japan; Arctic cyclone climatology. The student with prior programming knowledge with Matlab, Python, C, Fortran 90, GrADS, etc. may have an advantage undertaking the project, but, the senior students will guide those who do not have any experience. The research topics can be determined upon discussion with Prof. Waseda prior to the visit to Japan via e-mail exchange. We are happy to host those who are interested not only in research but also in learning about Japanese culture.</p>
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