Multiscale Fluid–Structure Interaction Analysis of Contact with Surface Roughness
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1. Study Abroad Destination: Rice University, USA

2. Dates of Stay: October 1st, 2017 - January 31st, 2018 (122 days)

3. Purpose:

To study fluid–structure interaction (FSI) and Reynolds equation.

4. Host Professor: Tayfun E. Tezduyar (Rice University)

5. Education and Research Activity at the Destination

Research Results:

My aim was to improve the understanding and knowledge of FSI and Reynolds equation. In these four months, I mainly did three things.

Initially, I studied the Reynolds equation. I discussed my direction for how to use the Reynolds equation in my research. In addition, I participated in Professor Tezduyar's FSI class twice a week, learned a lot from the class, and thought more about how I could do the FSI in the context of the Reynolds equation.

Next, we computed two cases as basic research. One was the flow between an engine cylinder and a piston including the piston ring. The ring is in contact with both the cylinder and the piston. The other was the flow in a foil bearing. In the second problem, the shaft sometimes contacts the foil. We also computed how the foil deforms due to the fluid pressure distribution.

Finally, I performed tire aerodynamics test computations with different methods of calculating the stabilization parameters and found good methods. From that, I can better differentiate between the numerical and physical oscillations.

6. Other Comments:

This was the first time for me to visit Rice University. In these four months, I really had a wonderful stay in Houston. I thank Professor Tezduyar for his kind help, even after I returned to Japan. The laboratory members were also very kind; they took care of me well.

Last day, we took a photo near the Mechanical Engineering building. I am grateful to Professor Takizawa and Top Global University Project of Waseda University for giving me the chance to study at Rice. This experience will be very helpful in my future research life.