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Felix Scholz, a junior researcher at Waseda University in Tokyo, researches the integration of computational geometry and computer engineering. More precisely, he develops geometry representations suitable for computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing.

“Classically, these areas have used different geometry representations, for example, smooth spline surfaces for CAD and finite element meshes for CAE, and a lot of effort was needed to translate one to the other in practical applications,” he says.

To solve the puzzle, Scholz has been using a newly developed method known as isogeometric analysis (IGA). IGA reduces the time needed for scientists and engineers to produce computer models or simulations of complex and diverse events such as hurricanes and car crash tests. “Currently, I am working on piece-wise developable surfaces—surfaces that can be manufactured by bending flat materials such as sheet metal without stretching them,” says Scholz. For example, this method can be applied to architecture, where buildings are designed using such surfaces for their ease of construction as well as their aesthetic properties.

Scholz made his way to Japan in November 2020 on the advice of his postdoctoral advisor at the Johann Radon Institute for Computational and Applied Mathematics in Austria, who told him about a position at Waseda. He successfully applied for the job and was fortunate to be offered a place in Kenji Takizawa’s laboratory at Waseda.

Takizawa is affiliated with the Multiscale Analysis, Modelling and Simulation (MAMAS) Model Unit at Waseda (see sidebar), and his laboratory is also a member of the Team for Advanced Flow Simulation and Modeling (TAFSM¹). TAFSM is focused on computational engineering analysis using a space–time computer modeling method developed by the team. By combining their method with IGA, they were able to more precisely model and analyze interactions between fluids and moving structures. This enabled them to solve modeling problems as varied and challenging as designing the parachute system for NASA’s returning Orion spacecraft and illustrating the effects of an aneurysm on blood flow to help clinicians.

Scholz was supposed to arrive in Japan on June 1, 2020, but that came undone with the rise of COVID-19.

¹ www.tafsm.org.
To prevent the disease from spreading, the Japanese government restricted overseas travelers from entering the country. Fortunately, Waseda was able to arrange for him to work remotely.

When the entry of foreigners was permitted again in October 2020, Scholz made new preparations and finally arrived in Japan in November. “But I had to stay indoors because the government had imposed a fourteen-day quarantine on people coming into the country,” says Scholz.

He was impressed with the care Waseda’s administrative staff took to help him settle in during those difficult early weeks. “For instance, I wasn’t able to use public transport on arriving in Japan because of the quarantine restrictions. So Waseda arranged private transport for me, and they set me up in an apartment in the university’s guest housing.”

Unique solutions to real-world problems

When he was finally able to visit the main Waseda campus in Tokyo, Scholz was delighted to find it larger than expected: “The area around the campus is very attractive; it’s very enjoyable living here.” He was also happy with his work location in the Institute for Frontier Fluid Structure Interaction Analysis, which is housed in the Green Computing Systems Research Organization. At the institute, Scholz and his colleagues tackle a wide range of real-world problems that few research groups are equipped to address. The classes of applications targeted include fluid machinery, ground vehicles, aerospace technologies, home appliances, and medical applications. “We have a large, active group that includes experienced researchers as well as bachelor’s, Master’s, and doctoral degree students.”

The plan is for Scholz to spend up to 3 years doing research at Waseda, which he believes will give him ample time to develop the skills and form the professional relationships necessary to advance his career. “I want to formulate efficient and powerful methods for numerical simulations on complicated geometries. Using new methods, we can increase the efficiency of the overall design process. I’d like to produce results that can be generalized and used to tackle a large class of applications stemming from real-world problems.”

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Previous winners of the HFSP Nakasone Award are listed on the HFSP website (see the link below).

Nominations must be received before 23 April 2021 and include the HFSP nomination form and the nominee’s CV. For more information see:

http://www.hfsp.org/awardees/hfsp-nakasone-award

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