Graduate School Event

Thesis Defense: Methods for Fluid Simulation, Surface Tracking, and Statistics of Non-Manifold Structures

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Host: Caroline Muller

Simulating fluids with non-manifold geometries presents a number of intriguing challenges. In my defense talk, I will discuss two projects in this area. In the first part, I will detail our surface-only algorithm for simulating the dynamics of a cluster of soap bubbles, both in terms of their large-scale shape and the evolution of their small-scale thickness. Coupling these motions at the very different length scales allows us to produce animations with bubbles popping and rearranging, while on their surface we observe swirling color vortices, rainbow interference patterns, and capillary waves. Bubble clusters form non-manifold structures, and as such, we have to be able to evaluate our equations of motion at non-manifold junctions. In the second part of my talk, I will discuss topological processing of non-manifold meshes in simulation. Mesh geometries representing soft matter can easily enter faulty states during simulation, such as colliding, inverting, self-overlapping and more, making it necessary to occasionally correct mesh topology to maintain physical plausibility. I will describe the algorithm we developed to tackle this problem in a non-manifold setting, such as when simulating bubble clusters. Our approach combines the ability to preserve surface details, similar to mesh-based methods, while reliably handling diverse topological changes, similar to level set methods. I will also touch on the aspects that make our algorithm numerically robust.

Monday, February 24, 2025 06:30pm - 07:30pm

Moonstone Bldg / Ground floor / Seminar Room F (I24.EG.030f) and Zoom

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This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
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https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.