

Master 2 Internship: GPU-programming for fast Collision Detection and application to Soft Robotics

Context:

The DEFROST team at Inria (<https://team.inria.fr/defrost/>) is specialised in simulation of soft robots for design and control.

Soft robots are traditionally made of silicone, but the team is investigating the use of 3D-printed meso-structure materials to construct new soft robots. In particular, the team is using the software IceSL (icesl.loria.fr) to print meso-structure in the shape of stochastic foams (such as described in <https://hal.inria.fr/hal-01697103/document>). Simulating the behaviour of materials with such intricate geometry represents a challenge, not only because it is hard to create a mesh matching the geometry of the inner-structure, but also, if we want to consider self-collisions, which are collision of the material on itself, typically when it is under compression. In this context, the detection of the self-collisions are very important since they influence the deformation of the material dramatically. However, with such complex geometry, a very high number of collisions may arise and this will not be tractable in real-time.

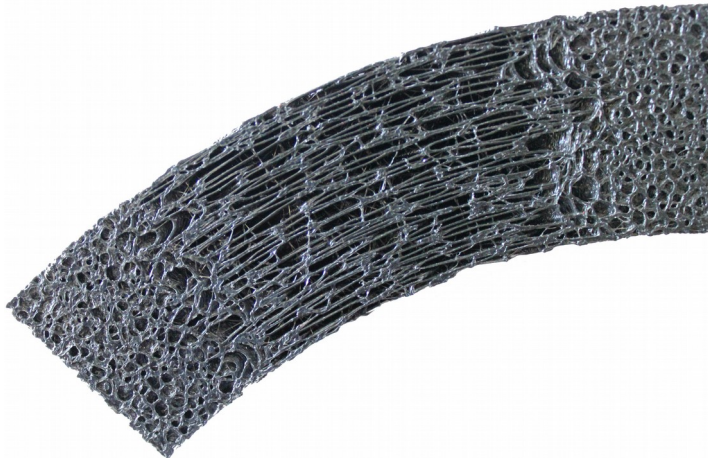


Illustration 1: Example of 3D-printed meso-structure using a stochastic foam

Short Work Description:

The DEFROST team is developing its simulation tools in the open source framework SOFA (<https://www.sofa-framework.org/>). The work will consist in updating the current implementation of collision detection in SOFA onto the GPU. An old implementation will be available to get inspired by.

Skills:

- Programming: Familiarity with C++, Python, and CUDA/OpenCL
- Some knowledge about Numerical Simulation and the Finite Element method is a plus.

Contact:

If interested, please contact Olivier Goury: olivier.goury@inria.fr
Expected start date: around March/April 2020.