Construction of gyroid Unit Cells

TECHNISCHE UNIVERSITÄT DARMSTADT

Bachelorthesis/Masterthesis
February 5, 2026

Description

In multiscale mechanics, the microscopic architecture of a material strongly influences its macroscopic behavior. By tailoring the geometry of representative unit cells, it is possible to deliberately design and program desired effective material properties.

This thesis focuses on the design and analysis of gyroid unit cells. Gyroid structures belong to the class of triply periodic minimal surfaces (TPMS) and are known for their distinctive geometric and mechanical characteristics. The possible scope of this work includes designing a parametric model, performing a numerical analysis and integrating the geometry in a multiscale optimization framework.

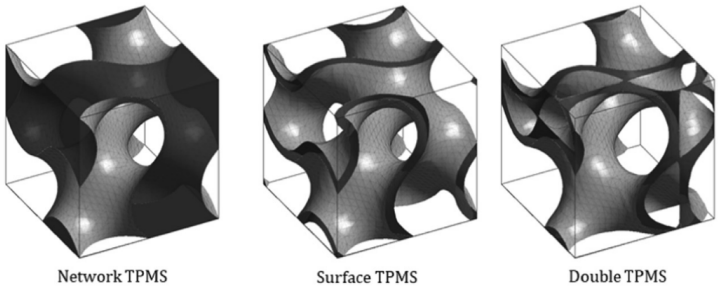

Figure 1: Example of a TPMS structure, Jones et. al, 2022

Recommended requirements:

- Programming knowledge (Python or similar)
- Finite-Element simulations

Contact:

Henrik Hembrock
Fraunhofer ITWM
hembrock@mechanik.tu-darmstadt.de

IFM INSTITUT FÜR MECHANIK

Prof. Dr.-Ing. Ralf Müller
ralf.mueller@mechanik.tu-darmstadt.de
Tel. 06151 16-22740

Fraunhofer ITWM

M.Sc. Henrik Hembrock
hembrock@mechanik.tu-darmstadt.de