Background

Von-mises stresses in femur bone

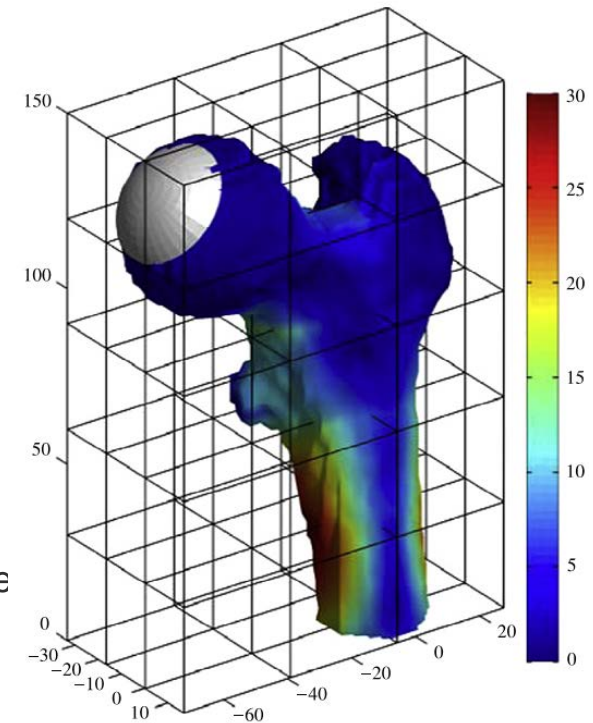**To develop mechanical parts you need to**

- come up with a design → parametric CAD

- verify structural strength → Finite Element Method

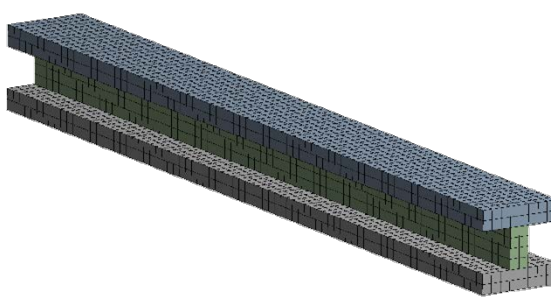- optimize your design → reduce weight, costs, …

Challenges

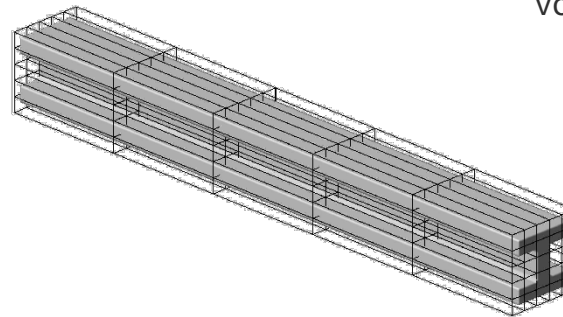- Standard FEM: change geometry → change mesh → cumbersome

Solution

- FCM → design, analysis and optimization can be fully integrated

N. Zander, T. Bog, M. Elhaddad, R. Espinoza, H. Hu, A. Joly, C. Wu, P. Zerbe, A. Düster, S. Kollmannsberger, J. Parvizian, M. Ruess, D. Schillinger, and E. Rank, "FCMLab: A finite cell research toolbox for MATLAB," Advances in Engineering Software, vol. 74, pp. 49–63, Aug. 2014.

I-Beam discretized using body fitted mesh   I-Beam discretized using FCM

Integrated Parametric Shaft Generator

Project Characteristics

Mechanics: ★★☆☆☆
Mathematics: ★★☆☆☆
Programming: ★★★★★

- The FCM is a powerful embedded domain method based on high order finite elements
- To promote the method using an industrial application, we will set up a demonstrator for parametric shaft generation
- The demonstrator will utilize the virtues of geometric modelling, high order finite elements, embedded domain approaches and automatic mesh refinement

Your task is to create an application that

- allows interactive design of shafts using a graphical user interface
- allows definition of boundary conditions and loads at various parts of the shaft
- carries out structural analysis
- visualizes results in GUI

Programming language: C++, Python, ..