The Chair of Applied Dynamics offers the following project or master thesis topic:

Moldelling fiber orientation of a rat left ventricle using finite element method

In research of heart pathology, rat hearts are usually investigated as surrogates. More importantly, when a rat heart beats the muscles of the left ventricle autonomously contract to pump oxygenated blood into the rat body. Mechanically, the response of the ventricle of the rat consists of two parts; the passive mechanical properties resulting from blood pressure in the ventricle chamber and the active response caused by the muscle contraction. To obtain the accurate mechanical properties of the left ventricle is however a challenging topic due to the fact that the muscle fibers in the ventricle are distributed with their orientations varying largely. The muscles are usually modeled as fiber-reinforced composites, leading to a stronger response along the fibers compared to other directions (anisotropic behavior). Thus, to capture accurately the response of the ventricle, fiber structure needs to be modeled and analyzed. The proposed method to solve this problem is the standard finite element approach using Abaqus. To validate the proposed model, simulation results for the fiber structure coupled with the mechanical properties of the ventricle can be compared with experiments performed by our cooperation partners at the Universitätsklinikum Erlangen. Consequently, modeling fibre sutructure, its implementation into Abaqus as well as its verification and validation are the main tasks of this research. This topic is conducted at the Chair of Applied Dynamics under the supervision of Dr. Minh Tuan Duong.

Qualification

- Students studying computational engineering, engineering, mathematics, physics, informatics
- Basic programming skills (in Fortran, Python desirable)
- Basic knowledge on matrices (or tensors desirable)

If you are interested, please email minh.tuan.duong@fau.de.