Structural Analysis of a Miniature Parallel Robot for Precise Milling in Surgery

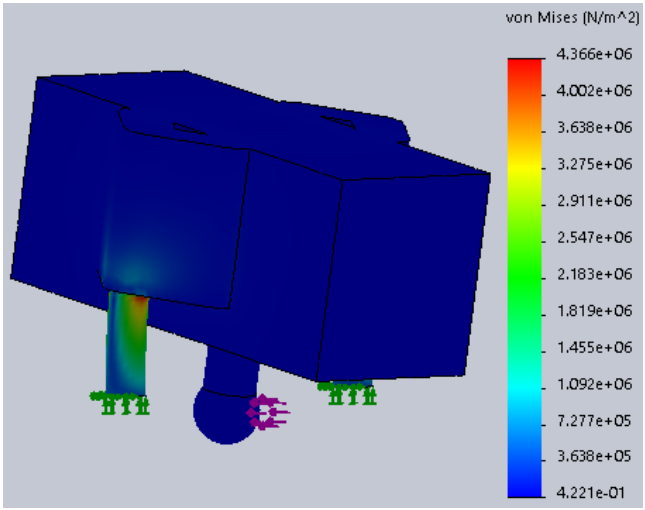

Figure 1: Finite element results of a model with a fixation structure in steel with a 1.5 mm diameter and a force along the endoscope axis - the Von Mises stress (Pa) is indicated with the colorbar (Picture: L. Aribi).

Master Thesis by Lina Aribi.

A study of the fixation design of the robot during bone milling.

In a current project carried out in the BIROMED-Lab, the robot cuts the bone with laser technology. Another possible alternative is to cut the bone by milling. In contrast to laser ablation, milling involves reaction forces transmitted to the robot during surgery. The tip of the endoscope (end–effector) is mechanically attached to the bone while milling. This project aimed to study the fixation design of the robot during bone milling by using finite element simulation.

Several models with different materials, different geometrical parameters of the fixation structure and different milling force directions were simulated. It could be shown that steel material, 1.5 mm in diameter, and force along the endoscope axis is preferred to avoid damaging the fixation structure.

Funding:

WSS
WERNER SIEMENS-STIFTUNG

Group Leader:
Prof. Dr. Georg Rauter
georg.rauter@unibas.ch

Supervisor:
Manuela Eugster
Cédric Duverney