# universitätfreiburg

# Master Thesis Proposal – ESE/MST/SEE/Math

# Optimal Positioning of Vacuum Clamps in autonomous Wood Processing Machines

Modern industrial machines are becoming increasingly autonomous. Woodworking machines are being developed to the point where they can manufacture workpieces without human operators. An important building block to achieve this, is to reliably clamp the wood panels using multiple vacuum clamps.

As shown in Fig. 1, the vacuum clamps are moved automatically to their respective positions by moving the carriers (depicted as gray horizontal bars) and the vacuum clamps thereon. However, finding the optimal positions for the vacuum clamps poses a significant challenge.

cutting contour (collision avoidance)



Figure 1: Left: Clamping on a real machine (workpiece depicted transparently). Middle: Degrees of freedom for clamp positioning. The cutting contour must be avoided due to collision avoidance. Right: Different types of vacuum clamps

The aim of this thesis is to develop an optimization algorithm that can determine the optimal position of the vacuum clamps in terms of holding force, while taking into account all the relevant constraints. These include the availability of clamps, collision avoidance, the maximum distance between clamps and more.

**Your skills**: A strong background in optimization as well as programming skills (Python/CasADi or other optimization tools) are necessary.

## General things:

- This thesis will be in coorporation with the company Homag GmbH.
  You will be in contact with the developers at Homag and have the possibility to visit the factory.
- There will be an internship contract (duration usually 6 months) and a compensation of 900 € per month.

Supervisors and contacts: Prof. Dr. Moritz Diehl, Ruven Weiss

If you are interested, please feel free to contact:

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