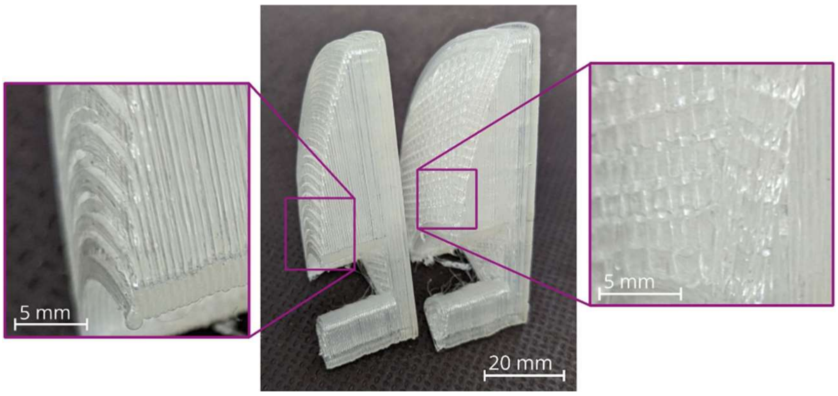
**Fakultät Maschinenwesen** Institut für Mechatronischen Maschinenbau
Professur für Werkzeugmaschinenentwicklung und adaptive Steuerungen

## Task for student research project or diploma thesis

# Development of non-planar-trajectory management ('real-3D') for additive manufacturing

Planar slicing in additive manufacturing, although widely used, leads to stair-stepping effects on curved surfaces, weaker interlayer adhesion, increased support material usage, and inefficient print path movements, limiting part quality and mechanical performance. Non-planar trajectory planning in additive manufacturing improves part strength, surface quality, and printing efficiency by allowing curved, adaptive print paths instead of traditional flat layers. This reduces the stair-stepping effect, enhances layer adhesion, and enables stronger, more durable parts by aligning material deposition with stress directions. It also minimizes support structures, reduces material waste, and allows for faster, continuous printing. Additionally, non-planar paths enable multi-axis 3D printing, making it ideal for complex geometries, aerospace components, medical implants, and robotic additive manufacturing. Overall, this approach enhances print quality, functionality, and efficiency, expanding the possibilities of 3D printing.




*Sample planar (left) & non-planar (right)*

### Required skills and capabilities of the student

- Programming (preferably Python)
- Basic knowledge of the concepts of CAD, CAM and path planning
- Basic knowledge of mechanical engineering, mechatronics or comparable engineering sciences

### Key tasks

- Research on established solutions for trajectory planning in additive manufacturing
- Selection of promising strategies for generating non-planar print paths
- Development of a concept for the automated generation of non-planar print paths

### Contact person

Dr.-Ing. Valentin Lang, Kutzbach-Bau Zi. E06, Tel.: 0351/463 34338,
E-Mail: valentin.lang@tu-dresden.de

PROFESSUR FÜR
WERKZEUGMASCHINENENTWICKLUNG
UND ADAPTIVE STEUERUNGEN