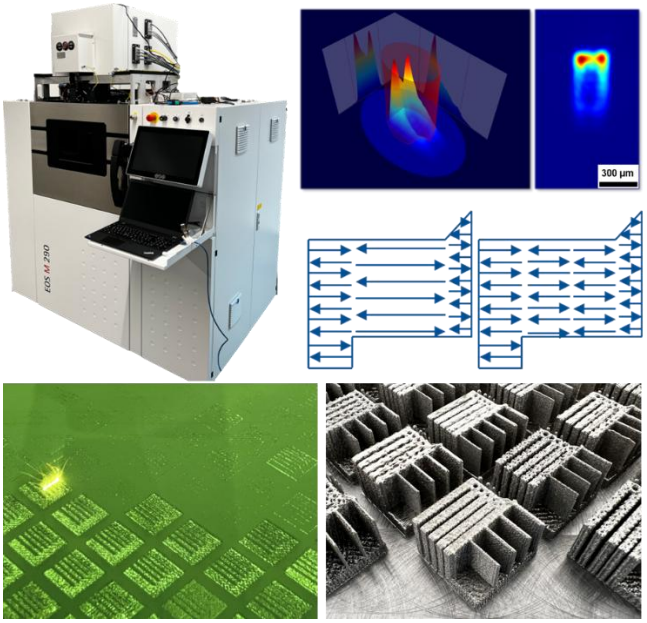
Technische Universität München
TUM School of Engineering and Design
Professur für Laser-based Additive Manufacturing

Simulation-Based Calculation of Vector Dwell Times for Controlling the Thermal Budget in Powder Bed Fusion of Metals (PBF-LB/M)

Initial Situation

At the Professorship of Laser-based Additive Manufacturing, we conduct research on innovative process strategies, methods, and systems in the field of metal additive manufacturing. Our focus lies on the process Laser-based Powder Bed Fusion of Metals (PBF-LB/M), in which thin layers of metal powder are selectively melted by a laser, building up parts layer by layer. Different laser beam shapes and their influence on key process characteristics are investigated. Besides the order of the scan vectors, introducing targeted dwell times between individual vectors is a promising lever to control the thermal budget.



Objective and Scope of the Thesis

The objective of this thesis is to calculate a vector-specific dwell time based on a thermal simulation, which specifically controls and homogenizes the thermal budget during exposure. In addition, preliminary studies shall explore the possibilities and limits of re-ordering scan vectors (e.g. due to powder denudation

The thesis comprises the following work packages:

1. Literature review on path planning and thermal budget in PBF-LB/M
2. Configuration of the simulation and development of a calculation approach for dwell times
3. Preliminary studies on scan vector re-ordering (e.g. powder denudation)
4. Verification of the dwell times in simulation and experiment
5. Evaluation and documentation of the results

You will be part of a student team of 3-4 members working together on closely related research questions. Each member conducts an independent thesis with regular exchange within the team.

Candidate Profile

- Initiative and creativity
- Analytical thinking and structured work
- Strong interest in additive manufacturing
- Programming skills (e.g. Python) beneficial
- Enthusiasm for teamwork

Application and Contact

Please send a short motivation letter and your current academic transcript to the contact below by September 13, 2026.
Candidate selection will be completed by September 18, 2026, followed by an invitation to an interview. The final decision will be communicated by the end of September, with the thesis starting on October 1, 2026. The thesis can be written in English or german.

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