



Der Vorsitzende des Promotionsausschusses

EINLADUNG

Hiermit lade ich ein zum öffentlichen Promotionskolloquium von

Herrn M.Sc. Felix Welsch
Intelligente Materialsysteme
(Prof. Dr.-Ing. Stefan Seelecke)

am

Mittwoch, 10. September 2025, 14:00 Uhr s.t.

per Videokonferenz: Link für MS Teams: <http://bit.ly/471IJ3K>
Raum für die Prüfung: Konferenzraum 10.1.09, Halle 10, ZeMA gGmbH,
Eschberger Weg 46, 66121 Saarbrücken

Thema der Dissertation:

Shape Memory Alloy Modeling and Simulation Tool for Elastocaloric Systems

Solid-state cooling is an environmentally friendly alternative to vapor compression-based systems, with no global warming potential. Elastocaloric (EC) heat pumps (HPs) based on Nickel-Titanium (NiTi) shape memory alloys (SMAs) exhibit excellent heating and cooling capabilities. This dissertation develops a multi-physics system simulation tool for multi-element EC HP systems, covering the thermo-mechanical coupled behavior of SMAs. A developed and realized material test bench allows for complete material characterization in a single test under realistic load conditions. The system simulation model supports massively parallel computation for comprehensive and systematic studies of distinct system parameters. To gain insight into the EC HP system's behavior, various design and operational parameters are simulated, compared, and interpreted for different SMA materials and heat exchange fluids. Additionally, system improvements like heat recovery or use as a low-temperature heat engine are introduced and evaluated.

Saarbrücken, 26. August 2025

Prof. Dr.-Ing. Georg Frey