Università degli Studi di Pavia
Computational Mechanics & Advanced Materials Group - DICAr

3D@UniPV
Virtual Modeling and Additive Manufacturing for Advanced Materials

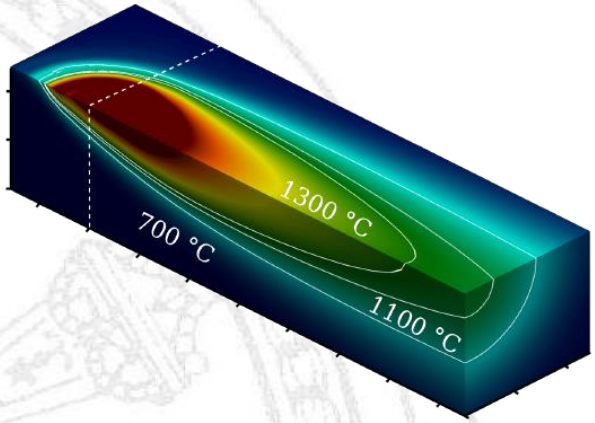
SEMINAR

Thermal finite element simulation and numerical optimization of PBF-LB/M

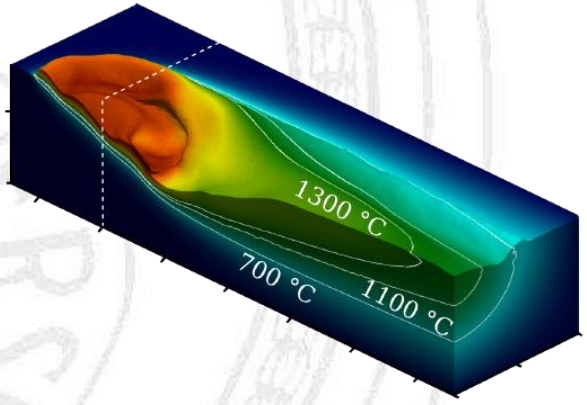
Laser powder bed fusion of metals (PBF-LB/M) is a popular additive manufacturing technology for 3D printing of metal structures. Most remaining challenges can directly or indirectly be related to the temperature evolution during the process. Modern PBF-LB/M machines allow adjusting the laser shape, speed, and power to increase productivity and reduce the amount of defects. Using the full potential of this flexibility requires extensive parameter studies that are often unfeasible when based on PBF-LB/M experiments. Numerical optimization provides an automatic, model-based parameter adjustment that is essential for utilizing modern PBF-LB/M flexibility.

The development of such algorithms splits into three topics: the model accuracy, the computational efficiency of the numerical approximation, and the design of objective functions for the optimization. Conduction models based on the heat equation are relatively cheap to compute and they provide good accuracy when heat conduction dominates. This talk discusses the efficiency of finite element discretizations of thermal models and their accuracy for various process states and laser beam shapes. Based on these results, numerical optimization will be used to develop new laser beam shapes with homogeneous temperature distributions inside the melt pool.

a) Heat conduction model



b) Multi-physics model



Philipp Kopp, Ph.D.
Bauhaus-Universität Weimar, Germany

May 16th, 17:00 (sharp)
Aula MS1, DICAr
Via Ferrata, 3 – Pavia