

Metal additive manufacturing: from theory to practice

Subject area: Mechanical Engineering

University: TUM
Level: MA all years, PhD
Teaching mode: completely online, at specific time
Instructor(s): Dr. Zirong Peng; Prof. Dr. Peter Mayr

Short description

This course will introduce metal additive manufacturing (MAM) and the various stages required in developing functional products. It contains modules of 1. feedstock materials, 2. design and topology optimization, 3. process simulation, 4. laser powder bed fusion, 5. direct energy deposition, 6. post-processing, 7. quality and defects analysis, 8. application. Through lectures, exercises, and case studies, learners will develop ideas on how MAM can assist the fourth industrial revolution.

Full description

Metal additive manufacturing (MAM) processes produce components by successively depositing materials layer-by-layer. In contrast to conventional subtractive manufacturing, which creates parts by removing materials and consequently causing enormous wastage, MAM is widely known to contribute towards sustainable manufacturing. MAM's other unique attributes are customized production, the inclusion of intricate geometries within functional products, thereby reducing resource-consuming inventory. Owing to these abovementioned qualities, many top-rated publications have forecasted MAM as a technology of the future. However, English-taught educational programs focussing specifically on metal additive manufacturing leaves much to be desired. To keep the future generation of EuroTeQ universities abreast with this emerging technology, we propose an introductory course in Metal additive manufacturing.

This course, in a massive open online format (MOOC), proposes to introduce metal additive manufacturing and the various stages which are required in developing functional products using the MAM. It contains modules of 1. feedstock materials, 2. design and topology optimization, 3. process simulation, 4. laser powder bed fusion, 5. direct energy deposition, 6. post-processing, 7. quality and defects analysis, 8. application. In line with the ethos of the EuroTeQ Engineering University, learners from various of life within the eurozone will be able to develop innovative solutions which are of pressing concern not just to their respective countries but also to the global north. Through various online lectures, exercises, case studies, and examples we aim at educating learners on how MAM can be an enabler of the fourth industrial revolution.

Learning outcomes

At the end of the course, the learner will be able to:

1. Understand the basis of the most prominent metal additive manufacturing, process workflows, design principles, materials selection and post-processing.
2. Gain essential insights into the importance of materials engineering and characterisation in the field of metal AM.
3. Apply the principles of topology optimisation and design for additive manufacturing guidelines for the creation of AM enabled value-added products and services.
4. Assess the suitability for using additive manufacturing as a substitute or a complementary technology vis-a-vis conventional manufacturing.
5. Appreciate the sustainability potential of metal additive manufacturing and create ecologically sensitive manufacturing and business models.

General information

Contact hours per week: 4

Total workload: 90 (in student hours for the whole course)

ECTS credits: 3

Language: English

Course start date: 01 September 2022

Course end date: 31 December 2022

Add. info about start date:

Weekly teaching day/time:

Time zone: CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

Further information:

Prerequisites: basic knowledge of manufacturing

Activities and methods: Lectures, Group work, Practices, Exercises, Tutorial sessions

Presence on campus:

Final examination

Form: written

Date:

Location/format: online

Re-sit possibility: yes

Transcript available:

Add. info/requirements:

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

Number of places:

Minimum participants:

Internal course code:

Contact: euroteq.incoming.zv@tum.de

This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit www.euroteq.eu or get in touch with the above-mentioned point of contact.