The doctoral program addresses the science and engineering of advanced manufacturing processes. It is part of the new **Micro-Manufacturing Science and Engineering Center (M2C)**. Advanced manufacturing is diverse, multiscale and multidisciplinary. It requires fundamental knowledge in materials, solid and fluid mechanics, surface and interface science, multiscale modeling, process and system engineering. More specialized topics include control system theory, production flow optimization, micro- and nanofabrication, laser processing, metrology, additive and subtractive 3D manufacturing, assembly and joining processes, sustainability and cost analysis.

Research topics of the advanced manufacturing program include:
Flexure-based oscillators

I am a PhD student working on flexure-based oscillators that aim to replace traditional mechanical watch oscillators (hairspring/balance wheel couple). This would bring many benefits, mostly thanks to the absence of friction in flexure mechanisms. Before reaching this goal however, several challenges need to be overcome and I am eager to tackle them. I am motivated by research that balances a rigorous academic approach with practical applications. This is why my thesis project, which combines scientific methodology and conceptual approach with the realization of prototypes and a possible implementation in a product as outcome, is ideal for me. I appreciate the environment in my lab, the good relationships with my colleagues, the freedom that I have managing my time and exploring new ideas. It is important for me to evolve in a place where there is space for creativity and initiative.

Being at EPFL also offers numerous advantages such as having the opportunity to teach, give seminars and attend conferences, being surrounded by high level scholars and having access to the resources necessary for innovative research.

Etienne Thalmann, PhD student in Micromechanical Design

3D Printing of metal parts with improved mechanical properties

Selective Laser Melting (SLM) is a part of a large family of Additive Manufacturing (also known as 3D printing) processes in which a part is made by selectively melting metallic powder in a layer wise approach. This manufacturing method gives the ability to produce parts with high added value and very complex geometries, which would otherwise be difficult or impossible to produce. Typical examples concern lattice structures used for aerospace and medical applications, bionic design for weight reduction, conformal cooling channels in tooling industry, etc.

Here at the Laboratory of Thermomechanical Metallurgy (LMTM) and as a part of my PhD thesis, we have developed and patented a hybrid SLM process called 3D LSP, which combines Laser Shock Peening (LSP) during the building phase of Selective Laser Melting by applying a multilayered 3D LSP confining system. Conventional LSP is a well-known surface treatment method used to introduce compressive residual stresses in parts used in high end applications and thus increase their fatigue life. By being able to apply LSP during the SLM process and “in the bulk” of the part while it is being made, we were able to introduce even deeper compressive stresses, decrease part distortion due to tensile stress accumulation and thus significantly increase fatigue life of the part.

With all the facilities available at EPFL, I have the opportunity to rapidly conduct cutting-edge experiments on equipment that is quite often very rare to find. This gives me the opportunity to work on a novel process, obtain very interesting state-of-the-art results and present them at renowned international conferences alongside some of the best researchers in the field which is a truly invaluable experience.

Nikola Kalentics, PhD student in the Laboratory of Thermomechanical Metallurgy
Why choose this doctoral program?

- Access to a large portfolio of laboratories
- Access to state-of-the-art technology platforms and core facilities
- International environment
- Education "à la carte" in a European leading university
- Experience in teaching at the university level
- Access to all EPFL courses and events including seminars, courses, training and industrial network
- Conviviality: participation to student retreat and other get-together activities
- Alumni PhD students have access to Swiss fellowships
- Life in a beautiful environment, Lausanne

Overview of the program

The duration of PhD studies is usually of four years or less. Students will obtain a doctoral degree from EPFL (Swiss Federal Institute of Technology).

During their PhD studies, students will participate in teaching (contact hours, supervision of bachelor students' projects).

Students will be followed by a PhD committee that offers guidance. A mentor will ensure that the student has settled satisfactorily into the lab and the program.

Graduate students complete their education by attending practical and theoretical courses, as well as seminars. Students are required to accumulate 12 ECTS credits during their doctoral studies.

Starting salary: 51'400 CHF (~44'000 EUR, ~52'000 USD)

Your application: how it works

There are three yearly application deadlines: January 15th, April 30th and September 15th. A first selection phase consists of the evaluation of your application file. Admission being extremely competitive, it is crucial to prepare it very carefully. Your application will be submitted directly to our program. A committee will evaluate and make a decision on your application, taking into account the research interests and potential thesis directors you indicate.

If you are admitted, you will have up to one year to enroll. If you are being hired by an EPFL lab, your contract will be organized during this time. Some time will also be needed to sort out any visa and residence permit requirements. Your application file must entirely be completed online, via the online application form.

phd.epfl.ch/application

Need more information? Visit us at

phd.epfl.ch/EDAM/en