Master of Science in **COMPUTATIONAL SCIENCE AND ENGINEERING**

2-year program - 120 ECTS

**Core courses** 30 ECTS
- Advanced numerical analysis
- Algorithms
- Computational physics III
- Computer simulation of physical systems I
- Dynamique moléculaire et simulations Monte Carlo
- Image processing I
- Introduction to multiprocessor architecture
- Machine learning
- Numerical analysis and computational mathematics
- Numerical integration of dynamical systems
- Parallel and high-performance computing
- Programming concepts in scientific computing
- Software engineering

**Modeling and numerical methods** 30 ECTS
- Computational modeling based on differential equations
- Advanced continuum mechanics
- Atomistic and quantum simulations of materials
- Biological modeling of neural networks
- Dynamical system theory for engineers
- Environmental transport phenomena
- Hydrodynamics
- Instability
- Numerical flow simulation
- Particle-based methods
- Principles and applications of systems biology
- Turbulence

**Computational modeling based on discrete systems** 8 min.
- Biomolecular structure and mechanics
- Computational methods in molecular quantum mechanics
- Digital 3D geometry processing
- Distributed intelligent systems
- Image processing II
- Introduction to electronic structure methods
- Mathematical foundations of signal processing
- Mathematical modeling of behavior
- Molecular quantum dynamics
- Signal processing for communications
- Understanding advanced molecular simulation
- Water quality modeling

**Numerical methods, algorithms, high performance systems** 8 min.
- Advanced multiprocessor architecture
- Combinatorial statistics
- Computational finance
- Computational linear algebra
- Convex optimization and applications
- Introduction to multiprocessor architecture
- Low-rank approximation techniques
- Mathematical modeling of DNA
- Numerical approximation of PDEs
- Numerical integration of stochastic differential equations
- Numerical methods for conservation laws
- Numerics for fluids, structures and electromagnetics
- Stochastic simulations

**Data science** 8 min.
- Advanced algorithms
- Applied data analysis
- Artificial neural networks
- Deep learning
- Foundations of data science
- Information security and privacy
- Mathematics of data: from theory to computation
- Optimization for machine learning
- Statistics for data science
- Systems for data science

In the Modeling and numerical methods group, students have to choose 3 out of the 4 lists and complete at least 8 ECTS in each of them.

**Internship**
The program includes a compulsory 8-week internship which can be extended to 6 months and combined with the Master’s thesis.

**Career prospects**
EPFL is a world leader in computing, engineering and fundamental sciences. A Master in Computational Science and Engineering from EPFL opens the door to top employment with computational skills in a broad spectrum of industries, not only in all branches of engineering, but also in emerging and vibrant market sectors including energy, financial and pharmaceutical R&D. It is also a strong asset for a PhD in Computational Science.

School of Basic Sciences
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