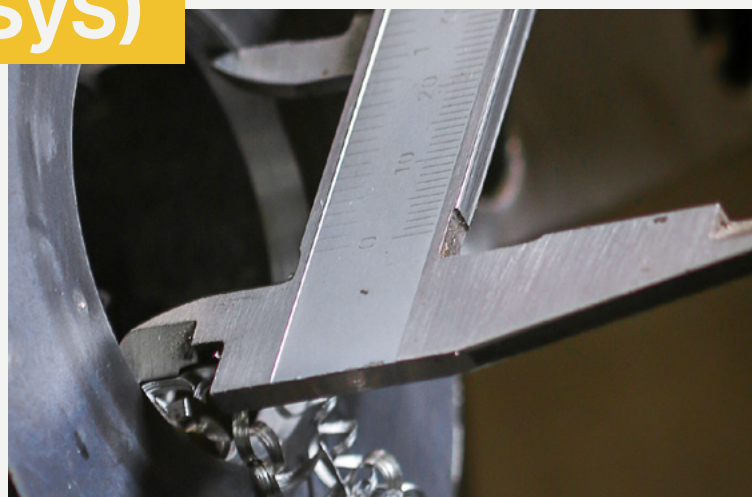


PhD Program in Systems Science (SyS)

IMT SCHOOL FOR ADVANCED STUDIES LUCCA

Systems Science (SyS) is an **international Ph.D. program** offered by the **IMT School**, one of the seven Schools of Excellence in Italy, which provides rigorous training and close supervision in **humanities, sciences, and technological disciplines**, welcoming multidisciplinary and interdisciplinary approaches at their boundaries. The IMT School is a truly **international environment** welcoming students and scholars from all around the world. The School has a record of placing students in top research universities, policy-making institutions, and companies. IMT School is a member of the EFC - Educating Future Citizens network: students and scholars have the opportunity to participate in joint activities and are encouraged to engage with partner institutions to foster academic and research collaborations. English is the official language of the School.



PhD Program in

Systems Science (SyS)

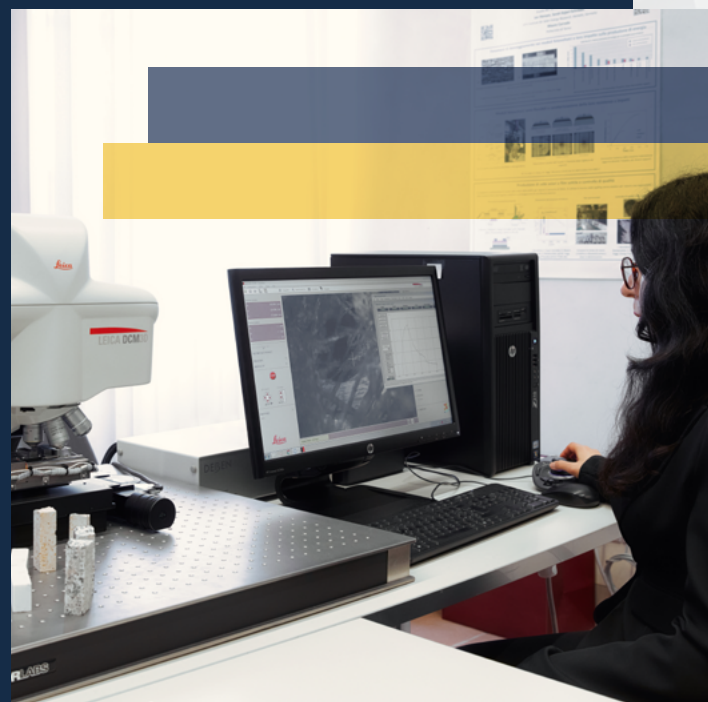
The PhD program in Systems Science (SyS) equips students with advanced skills for tackling research on **technological, natural, economic, and social systems using mathematical models**. Throughout their doctoral studies, SyS students learn various skills that enable them to create, employ, and implement techniques for analyzing and predicting complex phenomena. These techniques involve analytical, numerical, and computational models that originate from first principles or data, incorporating a range of interdisciplinary fields such as **mathematics, operations research, physics, statistics, computer science, and engineering**. The program encompasses several subjects such as **machine learning, network science, analysis and control of dynamical systems, time-series analysis, statistical physics, complex systems theory, numerical optimization, numerical integration of differential equations, statistics, stochastic processes, agent-based models, specification languages, programming, and software analysis**. SyS students acquire proficiency in these areas of study by pursuing one of four specialization tracks:

- **Complex Systems and Networks**
- **Computational Mechanics**
- **Learning and Control**
- **Software Quality**

Students compose tailored study plans by choosing subjects from a wide portfolio of basic and advanced courses, covering a minimum of 150 lecture hours. SyS students also have the opportunity to spend a study period abroad as visiting fellows.

SCHOLARSHIPS AND FUNDING

All students enrolled in the PhD program receive a **scholarship** of about €1,350/month, which includes pension contributions and results in a net salary of about **€1,200/month for 3 years**. As an exclusive additional benefit, students are offered **free on-campus serviced housing and full board at the IMT canteen**, worth an equivalent of about €800/month. Furthermore, they are given a research budget of about €4,000 to attend international academic conferences, summer and winter schools, and other similar events. During visiting periods abroad, the scholarship is increased by 50%, possibly receiving further funds from the **Erasmus+ program**.



PhD Program in

Systems Science (SyS)

CAMPUS LIFE

At the IMT School, a PhD isn't just about research - it's about **becoming part of a vibrant, international community in the heart of Tuscany**. Located within the stunning historical walls of Lucca, the IMT campus offers a unique blend of **academic excellence, personal growth, and everyday comfort**. One of the standout features of the IMT experience is the **dynamic campus life**. While PhD paths are often solitary, IMT transforms the journey into a **collaborative, enriching experience**. Workspaces and recreational areas are seamlessly integrated, encouraging students to connect, share ideas, and build lasting friendships.

All IMT students are guaranteed a **desk and have unrestricted access to the fully accessible campus**, thoughtfully designed to support both academic success and personal well-being. Modern amenities include cozy relaxation zones, coffee corners, kitchenettes equipped with cookers, microwaves, and dishwashers, as well as laundry rooms. When it's time to unwind, students can enjoy a dedicated Turkish bath, a fitness area, and a leisure room with ping pong, foosball, PlayStation consoles, and board games.

Student accommodations, located in the beautifully restored **San Francesco Complex** and the nearby **Brunero Paoli residence**, feature hotel-like shared double



rooms with private bathrooms. A campus **canteen** serves lunch and dinner daily, and **all students benefit from free housing and meals**.

The IMT School also offers outstanding academic facilities. With six spacious study rooms and 65 individual workstations reserved for students, students always have the space they need to work. The **IMT Library**, housed in the historic former **San Ponziano Church**, offers 32 exclusive study spots for IMT students, 86 additional seats for public use, and 24 private offices—four of which are bookable by students for deep, focused work.

At IMT School, students won't just study—they'll thrive in an environment designed to bring out their best, both professionally and personally.

PhD Program in

Systems Science (SyS)

INCOMING STUDENT PROFILES

Applicants who hold a **master's degree in computer science, engineering, physics, mathematics, statistics, or other related fields** are eligible to apply for the SyS program.

OUTGOING STUDENT PROFILES

Graduates of the SyS program can pursue a variety of career paths, including **academic positions in engineering, computer science, physics, applied mathematics, and other related fields**. Additionally, they can get opportunities in various **industries, services, public and private research laboratories, study centers, regulatory centers, consulting firms, and the public sector**.

Former SyS students have secured positions at top universities, prestigious companies, international institutions, research centers, and innovative start-ups, as evidenced on the Past Students page.



PhD Program in

Systems Science (SyS)

PROGRAM OVERVIEW

The PhD track in **Complex Systems and Networks (CN)** offers an interdisciplinary program focused on **complexity science, combining theoretical and computational tools for studying real-world systems in biology, economics, society, and technology**. The curriculum covers topics like graph theory, machine learning, and network physics, with applications to systems such as ecology, economics, and social networks. The program includes seminars, study abroad opportunities, and co-tutorships with international experts.

The PhD track in **Computational Mechanics (CM)**, coordinated by Prof. Marco Paggi, offers specialized training in **computational methods**, filling a gap not covered by undergraduate studies. This interdisciplinary program prepares students for both academic and non-academic careers, equipping them with the skills needed to address cutting-edge research problems. Research is conducted under the **MUSAM** - Multi-scale Analysis of Materials unit, with a focus on producing high-quality publications. The program offers access to high-performance computing facilities and experimental resources in the **MUSAM-Lab**. International collaborations and visiting periods abroad (3-6 months) are encouraged, with funding support. Double-degree agreements are available with some universities for earning a PhD in both Italy and another country.

The PhD track in **Learning and Control (LC)** offers interdisciplinary training for students interested in **developing algorithms for machine learning and controlling dynamical systems using numerical optimization**. These methodologies enable understanding system dynamics, predicting future scenarios, diagnosing issues, and improving system behavior through real-time control algorithms. The approaches are applicable to a wide range of real-world problems, such as autonomous vehicles, satellite attitude adjustment, and optimizing energy use in smart electricity grids.

The PhD track in **Software Quality (SQ)** focuses on the **software's whole life cycle, from requirements analysis to validation and testing**. The main aspects of concern are **program correctness, usability, accessibility, reliability, performance, and security**. The educational objective of the Software Quality track is to train researchers able to analyze, manage and anticipate software quality issues relevant to the digital transformation processes of society, including auditing and certification for software quality, digital identity, secure authentication and data privacy, design of interoperable cloud-based information systems, cost and energy efficiency of software systems, explainable artificial intelligence and systems for critical infrastructures.