Department of Innovative Technologies
The Department of Innovative Technologies (DTI) is active in Information Technology, Artificial Intelligence, Electronics, Mechanics and Industrial Production.

The Department engages in engineering education as well as applied research and technology transfer projects with companies.
The Department of Innovative Technologies offers various Bachelor Programmes:

- Bachelor in Electronic Engineering
- Bachelor in Engineering & Management
- Bachelor in Computer Science
- Bachelor in Mechanical Engineering
- Bachelor in Data Science and Artificial Intelligence

The Department also offers two Master programmes:

- Master of Science in Engineering
  - Master of Arts in the Teaching of Mathematics at Lower Secondary level

All the educational programmes are recognised at the Federal and European levels. Students must obtain a total of 180 ECTS (European Credit Transfer System) for the Bachelor programmes, 90 ECTS for the Master in Engineering and 124 ECTS for the Master in Teaching.

The educational programs offer a sound foundation for the students to build upon to develop into professional engineers.

Practical activities account for a large share of the program, ranging from over 20% of the program in the first year to roughly 40% in the third year.

Our close relationships with the job market enables nearly all DTI graduates to find employment readily.

SUPSI Electronic Engineering graduates are professionals who easily work in teams and can develop their expertise over time, thanks to their excellent education in the fundamental sciences, in the most modern technologies, in design and development methodologies and in communications.

The degree course has a four-semester common educational core, consisting of the fundamental scientific and technical subjects such as mathematics, physics, linear algebra, electrotechnics and analogue & digital electronics, software development, metrology and microelectronics. In the final two semesters, students can choose between the following subjects for specialization:

- Signal and control electronics with courses in mechatronics, telecommunications, embedded systems, etc.
- Energy, focused on aspects of centralised and distributed generation, transportation and distribution, and intelligent energy network management (Smart Grid)

Electronic engineers are professionals who operate on the frontier of modern technologies: they use electricity as a vector of information or energy and as a means of activation and control.

With the intelligent application of sensors, components for power and signal electronics, telecommunications, microcomputers and many other devices, they place technology at the service of the widest possible range of situations encountered in everyday life, industry and science. Our graduates can enter a broad range of potential careers, ranging from research and development laboratories, to energy or control system planning, and to marketing, and they can also take on managerial roles.

The Bachelor course in Engineering and Management focuses on training professional operators who can design and implement optimal solutions in both economic-financial and organisational terms, for all company typologies.

In the first two semesters, the Bachelor programme in Engineering and Management includes fundamental subjects such as analysis, linear algebra, physics and mechanics, introduction to programming, materials science and chemistry. Starting from the third semester, students deal with a range of professionalising subjects, such as production and logistics, industrial plant management and industrial production. In their fourth semester, students can choose between six specialist study options:

- Industrial sustainability
- Industry 4.0 and the factory of the future
- Additive manufacturing
- Logistics
- Pharmaceuticals
- Aviation
“A SOUND EDUCATION IS ESSENTIAL TO FOSTER THE QUALITY OF SWISS INDUSTRY”

Stefano Modenini
Director of the Association of Ticino Industries (Associazione Industrie Ticinesi – AITI)
“SUPSI IS THE IDEAL PARTNER FOR PROFESSIONAL EDUCATION AND FOR DEVELOPING INNOVATIVE PROJECTS”

Francesco Siccardi
Chief Executive Officer
Medacta International SA
Bachelor in Computer Science

The degree course in Computer Science trains professional operators with an in-depth understanding of the development and conception methodologies of software systems, and of systems management in the Information Technology (IT) field. The Bachelor in Computer Science is extremely practical oriented, and closely linked to the business world, in order to facilitate students in the process of entering the labour market. In addition to the fundamental scientific subjects in common with the other programmes, the course also includes subjects such as databases, digital technology, languages and programming, modelling and simulation, computer architectures, telematics, cyber security, computerised graphic design, operating systems, data management systems, algorithmic and software engineering. In the third year, students can specialise by choosing options, which include the following new modules:

- Internet of things
- Virtual reality
- Game development
- Data science
- Multimedia processing

The specialisation options are updated annually in order to adapt them to technological developments and market requirements, so that students are ready to successfully deal with real-life professional situations. At the end of the final year, students must work on their Bachelor projects, in collaboration with a company or research institute. Computer scientists are typically employed as designers or developers, or in the management of IT infrastructures and systems in a diverse range of company environments. In addition to subject-based expertise and methodologies, the programme also focuses on social and communication skills, because computer scientists usually work in teams, often multi-disciplinary, where they have to interact with colleagues and clients. For this reason, they must be able to collaborate and take responsibility in a group situation. Together with communication skills, group projects represent an important aspect of the entire course. The programme also includes in-depth study of aspects related to economics and entrepreneurship.

Bachelor in Mechanical Engineering

The degree course aims to train professional operators who can combine theoretical-scientific aspects with the ability to identify, formulate and resolve, in an innovative manner, complex issues or problems requiring an inter-disciplinary approach.

In the first two semesters, the curriculum focuses mainly on fundamental subjects, such as mathematics, algebra, analysis, physics and chemistry, thus providing students with a sound basis to continue their studies. In the following semesters, alternating theory lessons with practical exercises and laboratory work, the focus moves to professionalising subjects, such as: machine elements, materials resistance, finite element analysis, automation, robotics, composite materials, fluid dynamics, and thermodynamics. In the third year, students can broaden their knowledge, though optional modules oriented toward the following themes:

- Design and production
- Energy
- Railway technology

Mechanical engineers do not work simply on product development, since their fields of operation extend to the design and control of production processes. For this reason, these professional operators are the most commonly found in Swiss companies in comparison with other engineering typologies. Their main career opportunities lie in the mechanical and electro-mechanical industries, companies and organisations for energy conversion, plant building companies, automation and robotics industries. New graduates can find employment in a range of departments, such as technical offices, research and development, times and methods, quality control, sales and production.

Bachelor in Data Science and Artificial Intelligence

Graduates from this program understand the fundamental methods of Artificial Intelligence and Data Science, and can implement these methods, deploying them, for example, in companies with large amounts of data and that want to implement data-driven decision making (banks, financial and marketing institutes, insurance companies, public bodies, manufacturing industries, pharmaceuticals, the service sector, and the medical/biological sectors).

Data Science and Artificial Intelligence graduates can:

- Operate in the various data analysis phases, including: data collection, choice of analysis method, implementation and evaluation of results, evaluation of ethical, legal and privacy implications;
- Implement software libraries based on machine learning; evaluate and optimise the accuracy and scalability of such libraries;
- Communicate the results to a non-specialist audience;
- Build automatic and efficient systems for dealing with Big Data;

In each course, preference is given to active learning through practical exercises and laboratories, as well as project work. Interactions between courses carried out both in series and in parallel are also promoted, by means of transversal case study analyses. Numerous multidisciplinary and team activities such as data challenges, hackathons and seminars will be proposed.

Courses are conducted in English. Students may attend some courses in Italian, should these already be scheduled by the Department.
**Master of Science in Engineering**

The Master of Science in Engineering (MSE) is run jointly with the other Swiss Universities of Applied Sciences and Arts. The programme is organised over 3 semesters, awarding a total of 90 ECTS.

The theoretical part of the program accounts for at least one third of the credits, with the remaining two thirds dedicated to in-depth professional study (projects, research work, seminars). The lessons are held in Lugano in English, in Lausanne in English or French, and in Zürich in English or German.

The practically oriented MSE is characterised by great scope for personal choice. The student can choose the focal points of his/her course of study to suit his/her personal interests and career plans to a large extent.

The MSE offers 14 specialization profiles in the areas of Engineering and IT and Construction and Planning:

- Aviation
- Business Engineering
- Computer Science
- Data Science
- Electrical Engineering
- Energy & Environment
- Mechatronics & Automation
- Mechanical Engineering
- Medical Engineering
- Photonics

The students acquire the know-how to become the technical specialists / management staff of the future, for both the industrial and the public sectors. Graduates will find career opportunities in the following areas: research and development, production, logistics and consulting. Moreover, when necessary, their contextual and communication expertise will allow them to run projects and work groups, and to operate efficiently at the international level.

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**Master of Arts in Mathematics Teaching**

The Master of Arts in the Teaching of Mathematics at Lower Secondary level is conducted in collaboration with the SUPSI Department of Education and Learning. The programme lasts for three years and awards 124 ECTS.

Students spend most of their first year at the Department of Innovative Technologies and focus on the basic aspects of general-purpose and subject-specific teaching methods. Students spend most of the rest of the program at the Department of Education and Learning in Locarno, and at one or more public middle schools in Canton Ticino, where they can gain hands-on experience.

The programme focuses on the interaction between professional practice, theoretical modules and research in education, and aims to construct a solid knowledge basis founded on the acquisition and progressive command of a key didactic and educational toolkit.

The programme trains participants to teach mathematics at middle school level, a profession serving the cultural development of citizens. In addition to a solid subject-based, didactic and pedagogic education, the teaching profession also encourages its proponents to view the future in a spirit of open-mindedness and curiosity.

Teachers are in constant contact with the new generations, and with the challenges and needs related to their development and growth.
Continuing Education

The Department of Innovative Technologies conducts a wide range of engineering continuing education courses. The programmes consider both the ongoing technological developments and the market demands in terms of industry and services. There is a common approach to all the courses, which combines the transmission of theoretical knowledge with practical activities. On average, this latter component amounts to 50% of the teaching hours specified for a course and ensures that participants know how to apply their acquired technical expertise to real-world situations.

In addition to the extensive catalogue of courses focused on electronics, information technology, industrial engineering and project management, DTI Continuing education programmes may also include customised courses designed in line with the requirements and needs expressed by the counterparty.

The educational programmes are designed in such a way that attendance is possible in parallel with professional activity, so that students can obtain the relative diplomas or certificates without in any way compromising their company positions. The programs include:

- **Master of Advanced Studies**
  Leading to a diploma recognised at the federal level, these courses constitute a solid basis for subsequent professional development (60 ECTS).

- **Diploma of Advanced Studies**
  Educational courses, usually offered every two years, and with a minimum of 360 teaching hours, leading to a qualification recognised by the University of Applied Sciences and Arts of Southern Switzerland (from 30 to 59 ECTS).

- **Certificate of Advanced Studies**
  These are 120 – 250 teaching hour study programmes, leading to a certificate recognised by the University of Applied Sciences and Arts of Southern Switzerland.

- **Short term courses**
  These courses differ from the other educational programmes since they vary from a minimum of 12 to a maximum of 48 teaching hours. Participants receive an attendance certificate.

- **Events and Webinar**
  The Departmental Continuing education office also organises one-day educational events open to all, as well as free, online lessons at lunchtime on topics of broad interest, such as leadership, effective communication and project management.

In addition to the expertise of the instructors who are also active in research and development projects, the DTI continuing education program enjoys a close collaboration with external organisations, including public institutions and private companies both in Switzerland and abroad. This close connection to employers ensures that the educational offer is always aligned with the needs of the job market.

The Department plans and implements its course catalogue by creating synergies with local professionals, and exploits the experience of instructors from industry and academia.

The Departmental Continuing education office operates in the following areas:

- **Electronic Engineering**
- **Industrial Engineering**
- **Computer Science**
- **Project management**
- **Fashion Innovation**
Services to companies and support to the region

The Department offers the technology transfer and innovation services listed below to companies, institutions and organisations in the region.

- Computational analysis in the biomedical and pharmaceutical sector
- Database analysis and model calculation for predictions, classifications and forecasting
- Analysis and calculation of sustainability impacts
- Non-invasive analysis of materials
- Microstructural characterisation
- Rheological characterisation and plastic injection process simulation
- Fabless ASIC (Application Specific Integrated Circuit) design and FPGA (Field Programmable Gate Array) design
- Computer forensics
- Metrology in the RF (Radio Frequency) and EMC (Electromagnetic Compatibility) domain
- RNI (Non-ionising radiation/electromog) measurements
- Design and integration of machines and robots in production contexts
- Virtual prototyping with finished elements
- WLAN networks (Wireless Local Area Network) simulation and planning
- Development of discrete event simulation models of production processes
- Development of advanced control systems for operating machinery
- Development of artificial vision systems for industrial processes
- Development of optimization tools based on Artificial Intelligence and Machine Learning methods

Departmental collaboration networks

The Department of Innovative Technologies can leverage an extensive network of collaborations at the regional, federal, and international level to foster its research and development and educational activities.

The Department promotes exchange programmes with prestigious universities and institutions, as well as joint research projects, particularly in the context of Horizon Europe, Eurostars, and Eureka programmes. DTI further aims at playing a major role as a leading university at the global level in its fields of expertise.

At the federal level, the Department collaborates actively with the Swiss university network, and particularly with the other Universities of Applied Sciences operating in the engineering field, in terms of educational and joint research projects supported by the State Secretariat for Education, Research, and Innovation (SERI).

The Master of Science in Engineering (MSE) was developed in collaboration with the other Swiss Universities of Applied Sciences. The MSE includes the SUPSI Department of Innovative Technologies as a provider of federally-recognised specialist courses.

Equally important in the applied research field are the thematic networks and projects supported by the Confederation through the Swiss National Science Foundation and Innosuisse, in which the Department is a recognised scientific partner.

Thanks to its participation in national and international networks, the Department has global connections to top talent that maximize its effectiveness in education and research.

The Department trains the next generation of engineers to be employed locally or internationally, offers continuing education for local professionals, and runs applied research project with companies in the local region as well as nationally and internationally.

The collaboration with local companies ensures the development of joint projects and initiatives with institutions (Canton Ticino, USI, the AGIRE foundation, the Centre for Start Up Promotion), and also with economic associations such as AITI, Chamber of Commerce, Farmaindustria Ticino, Ticinomoda, as well as with many local companies.
Research and technology transfer

The quality of the Department's research is appreciated locally, nationally, and internationally. Locally, the Department represents a reference point in the economic fabric.

The Department engages in applied research and technology transfer activities through its active involvement in networks, initiatives, and projects supported by a wide array of extramural funding sources.

The topics tackled involve the different engineering disciplines covered by the Department, ranging from computer science to electronics, from mechanics to materials, from production to artificial intelligence.

The following five research institutes operate within the Department: Dalle Molle Institute for Artificial Intelligence (IDSIA), Institute for Systems and Applied Electronics (ISEA), Institute for Information Systems and Networking (ISIN), Institute of Systems and Technologies for Sustainable Production (ISTePS), and Institute for Mechanical Engineering and Materials Technology (MEMTi).
IDSIA has been researching on artificial intelligence (AI) since 1988, and it now develops basic AI research in combination with research work applied to industrial and economic contexts.

The main research topics of the institute focus on automatic learning (machine learning, artificial neural networks, imprecise probabilities, data science), optimisation (heuristic, simulation, computational sciences, decision support systems), and cognitive and swarm robotics.

IDSIA's staff is composed of about 80 people, including many data scientists who can solve complex problems thanks to their solid foundations in mathematics/statistics. IDSIA has achieved international recognition as a pioneering AI institute, thanks to the algorithms developed by its researchers, such as LSTM neural networks, which are nowadays used in numerous AI systems and devices. IDSIA researchers combine their essential methodological know-how with strong skills in the development of real-world applications. The Institute turnaround amounts to approximately 4 million francs per year; this amount is split between different research funding sources: Innosuisse application projects, usually in collaboration with companies, European Commission funded projects assigned to influential competence networks to which IDSIA belongs, basic research projects financed by the Swiss National Fund for Scientific Research (FNS) and by the European Research Council (ERC). One of the outcomes is a considerable scientific production: every year more than 100 scientific papers are presented at conferences or published in peer-reviewed journals. Also patents are invented and developed during the research projects' lifetimes. More than half of the academic staff is also involved in didactic activities at all levels: Bachelor, Master, PhD and continuing education. The impact of the work performed by the Institute has been acknowledged on numerous occasions, such as in 2016, when it received the Swiss ICT Special Award 2016.

### Machine learning e data mining

Learning from experience (machine learning, ML) is often the best method for solving difficult, real-life problems. IDSIA implements ML to tackle problems such as the probability of a patient suffering from a specific illness, image interpretation, support in decision processes and system auto-calibration. The aim of the ML research work conducted by the Institute is to develop methods that prove reliable when data are the only possible source of information. The neural networks developed, together with the algorithms, provide credible solutions, even with incomplete data series and on large data sets (big data).

### Optimisation and decision support systems

The effective solution to a problem related to planning, management or operational control can be obtained by means of appropriate AI algorithms, which, in turn, are based on simulation models and on decision support systems. IDSIA is working to find solutions to the problems of goods transportation and car-sharing, for production optimisation and electrical energy use, and for robot scheduling systems. Applications reach the computational biophysical sphere, in order to optimise drug delivery systems.

### Cognitive robotics and swarm robots

IDSIA studies human–robot interaction and swarm robot management (including drones), even without a centralised control. The methods implemented range from insect behaviour inspired architectures, to control devices derived from machine learning, and to other techniques based on evolutionary robotics.
Institute for Systems and Applied Electronics

ISEA works on systems and technologies related to electronics and technical computer science, applied to product development. ISEA’s staff is composed of about 60 people, including 4 professors, more than 40 researchers and teachers, numerous assistants and interns. The Institute groups together specialist know-how and highly-qualified people, therefore offering a state-of-the-art and appealing degree course in electronics. It also conducts significant applied research activity, in close contact with industry, public bodies and other academic institutes.

As suggested by its name, the terms “systems” and “applied” emphasise the applicative nature of the activities conducted, aimed at supporting innovation in businesses by jointly developing new products and methodologies, improving production processes and transferring knowledge.

With an annual budget of approximately 3.8 million Swiss Francs, research work consists of regularity more than forty projects financed by the Swiss Innovation agency Innosuisse, European research programmes or bodies, foundations or direct mandates. Its specialized know-how and highly-qualified researchers make ISEA the ideal partner for industrial high technology projects in various sectors: industrial, telecommunication, biomedical, environmental, aerospace and automotive.

Electronic systems

ISEA has scientific expertise in the fields of analogue and digital electronics, discrete and integrated, embedded intelligent systems equipped with microprocessors, microcontrollers and specific communication interfaces. Activities range from the design of electronic platforms to the development of technical software and firmware, programmable integrated components (CPLD, FPGA) and on silicon (mixed signal ASIC), to applications based on integrated DSP algorithms. The Institute works on the treatment of analogue signals and has experience in high and low power electronics and in wired (fieldbus) and wireless communication.

RF electronics, antennas and telecom

The Institute has a remarkable expertise in radiofrequency (RF) and microwaves technologies: ranging from electromagnetic field modelling and simulation, to system design, to testing with RF instruments. Activities span from the development of telecommunication systems to the integration of communication protocols, to antenna design and to applications for identification (RFID) and localisation (GPS). Specific focus is placed on the use of low-power micro-waves in applications ranging from industrial (non-invasive analysis of materials), to medical (tomography), and environmental (radar for terrestrial monitoring). ISEA holds a METAS (Swiss Federal Institute for Metrology) accreditation for non-ionising radiation metrology.

Mechatronic and microtechnical precision systems

ISEA is engaged in the design and control of electrical machines and in the design of miniaturised electromechanical systems, actuators, sensors and positioning systems. This expertise is applied to the development of medical and rehabilitation systems, for cell culture, and also in the machine industry by means of high-precision, dynamic systems and work process controls. The Institute also has expertise in rapid-prototyping and in real time software development.

Electronic systems for energy and power electronics

In terms of the design of electronic systems for energy, ISEA focuses on the management, reduction and optimisation of energy consumption. The application fields cover smart metering, energy scavenging, smart-home, smart-grid and smart-cities.

Optoelectronics and applied photonics

In the field of electronics for light, research activity is conducted in photonics, optoelectronics, colorimetry, spectrophotometry, laser systems and triangulation, imaging and lighting techniques.

Electronic systems in the medical and assistive sector

ISEA conducts research projects in the medical sectors of diagnostics, tomography and electromyography. It is also working on applications aimed at Active and Assisted Living (AAL) for elderly and differently abled persons. The Institute has expertise in terms of requesting authorisation from Swissmedic and from the Cantonal Ethical Committee, essential for performing experimental tests in hospitals.
The Institute for Information Systems and Networking (ISIN) is an ICT research institute with a strong expertise in applied computer science as well as data and network science.

Established in 2009, today ISIN employs about 45 professionals who engage in teaching and research. ISIN runs SUPSI’s educational programmes in Computer Science at the Bachelor and Master level, in addition to several continuing education programmes.

Applied research projects and academic activities are carried out in cooperation with Swiss and international partners and are funded through competitive external sources, such as Innosuisse, the European Commission, the Swiss National Science Foundation, as well as other private foundations. Technology transfer activities are typically supported directly by business partners.

Research at ISIN follows primarily three scientific directions: human-computer interaction and communication systems; data analysis, processing, and cybersecurity; multimedia and educational technologies. ISIN professionals leverage a substantial core strength in a wide array of topics, including programming languages, development frameworks and tools, software architectures, development paradigms and methodologies, operating systems, databases and storage systems, data mining, computer graphics, networking architectures and protocols.

Human–Computer Interaction and Communication Systems

Today, the Internet is accessed by advanced human-machine and machine-machine interfaces provided on computers and smart devices. Users and things perform pervasive forms of communication, where everything can talk to everything else. Humans are part of complex systems integrating sensors, actuators, and infrastructure in a wide range of application fields ranging from smart living to smart industry.

ISIN’s expertise includes: human-computer and computer-computer interfaces, distributed and polymorphic user interfaces, natural language processing, smart sensing frameworks (wearables), IoT and mobile application development, wireless technologies, wireless sensor networks, pervasive computing, cyber physical systems for smart homes/cities/regions, social media/networks, cognitive and semantic systems, behavioural analysis.

Data Analysis, Processing and Cybersecurity

The value of data is continuously growing in our information society. Structured and unstructured data from heterogeneous sources must be safely collected, stored, and processed for value extraction. Exposure to hacking attacks and sabotage resulting in data loss and data breaches must be avoided at all costs. ISIN’s expertise includes: cloud native applications and cloud APIs, micro-service architectures, web technologies, big data analytics, data visualization techniques, distributed and parallel computing, distributed ledger technologies (blockchain), cybersecurity, privacy, and data protection technologies.

Multimedia and Educational Technologies

Today’s advanced multi-media technologies can leverage high-definition audio-visual content, while solutions for virtual and mixed reality allow users to experience new artificial dimensions that coexist with our real world. Audio, video, and immersive multimedia applications enhance our experience in many sectors from entertainment to manufacturing to education. ISIN’s expertise includes: development of applications for digital signal processors and systems on chip, digital signal processing techniques, GPU computing, audio/video streaming and processing, computer vision, software infrastructures for scientific simulation, virtual/augmented/mixed reality, 3D-audio systems, serious and educational digital gaming, educational and training technologies, and open data.
“SUPSI: TRAINS ENGINEERS LOCALLY TODAY SO THAT THEY CAN PURSUE GLOBAL OPPORTUNITIES TOMORROW”

Alberto Pura
Technical Manager Schindler Electronics Ltd
“MY SUPSI EDUCATION GOT ME TO HARVARD – MY DREAM CAME TRUE”

Gianluca Costante
Master of Science in Engineering
Institute of Systems and Technologies for Sustainable Production

The Institute of Systems and Technologies for Sustainable Production (ISTePS) was created in 2013, uniting two laboratories that had already operated for a number of years, in order to conduct first-level university programmes and continuing education courses, applied research and services related to the innovation in terms of products, production processes, manufacturing systems and business models. Research topics focus on business and supply chain management, mass customisation and sustainability, digital factory and simulation, robotic and modular production systems, industrial systems and technologies for additive manufacturing and 3D printing. ISTePS has 45 researchers with academic qualifications and industrial backgrounds in the various engineering disciplines required for production system design and management. This range of expertise and experience allows researchers to apply their strong formal approach to designing innovative solutions, and to actualise them with the necessary industrial application procedures. The research activities are strongly focused on international projects, particularly those financed by the European Union.

The knowhow developed in this manner is then applied to national Innosuisse projects and in numerous direct mandates established with leading Swiss companies, amounting to an annual volume of 3.5 million francs. Project outcomes are used by industrial partners and often lead to patent applications, while in the academic sphere, they give rise to the publication of books and articles for conferences and international journals, and are also incorporated into first-level university programmes and continuing education courses.

The quality of the work executed has been acknowledged by the European Commission on more than one occasion: for example, in 2014 and 2015, when the Institute received the Innovation Prize and the Best Industrial Practice Award.

Innovative business models for companies and supply chains

This area focuses on supply chain configuration and develops management models for distributed production networks. Concurrently, it develops circular economy business models and servitisation models that combine management and technological expertise, as well as approaches focusing on lean production and total quality.

Mass customisation and sustainability

In this area, models and instruments are developed for certifying the sustainability of products, processes and supply chains that embrace their entire life cycle. The mass customisation paradigm is also applied and developed, together with the sustainability themes referred to above.

Digital factory and simulation in the Industry 4.0 context

This area deals with the digitalisation of the production activities, developing models and tools for factory virtualisation, production process simulation and synchronisation between the real and digital worlds, in a Factory 4.0 context.

Robotised and modular production systems

This area evolves around research topics relevant to the design, configuration, engineering and integration of flexible and customisable industrial robots, in order to create highly complex and extremely precise industrial processes, by means of solutions that are modular and that can be reconfigured in terms of the kinematic, dynamic, control, trajectory and process planning aspects.

Industrial systems and technologies for additive manufacturing and 3D printing

Work in this area focuses on designing, engineering and developing machine solutions and innovative integrated systems for the additive manufacturing of metallic and composite materials, as well as individual modules to integrate into existing machine solutions, implementing hybrid multi-material deposit and ablation processes controlled by closed loop monitoring systems.
The Institute for Mechanical Engineering and Materials Technology (MEMTi), formerly known as ICIMSI, focuses on manufacturing and energy and develops novel technical solutions to meet new market needs and make products more competitive. MEMTi employs about 45 professionals who conduct research and teaching activities.

MEMTi engages mainly in applied research projects, with a yearly research expenditure of approximately 3 million Swiss Francs funded by competitive external sources such as Innosuisse as well as industry contracts. Basic research activities are also significant and often result in high impact publications.

As for teaching, MEMTi plays a major role in the Bachelor program in Mechanical Engineering.

**Manufacturing process design and optimization**

Simulation is becoming the most widely used tool for the design and optimization of manufacturing processes such as injection moulding, metal forming, welding, and additive manufacturing. MEMTi specialises in simulation techniques for the evaluation of the effect of the manufacturing parameters on the mechanical behaviour of the product being manufactured.

**Structural mechanics**

MEMTi develops innovative products and machines through a blend of design creativity and engineering excellence. We have experience using Finite Element Analysis computational techniques to optimize and verify static and dynamic structures as well as to assess their resistance, stability, and long-term fatigue and creep reliability. Our approach takes into account material processing parameters at design time in order to bridge the gap between manufacturing and product performance.

**Termo Fluid Dynamics**

MEMTi specializes in the analysis and optimization of the thermo-fluid dynamics of components, processes and systems. Application fields include thermal and electrical energy storage systems, innovative solar receivers, multiphase flows, and medium/low temperature district heating networks. MEMTi also tackles engineering problems involving thermal management and external aerodynamics.

**Hybrid Materials**

MEMTi specializes in hybrid materials, with a specific focus on polymeric and ceramic matrix composites, as well as porous ceramic materials. In recent years, MEMTi has also developed an extensive know-how in additive manufacturing techniques for the production of complex ceramic components.

**Computational materials science**

MEMTi has strong expertise in physical-chemical and multiscale molecular modelling, which are established tools for the study and design of new types of materials for a wide range of applications, ranging from biomedical to advanced technological materials. Our technical skills span from atomistic to multiscale molecular modelling approaches, and from classical to advanced computer simulation and data analysis approaches. Along with a solid background in theoretical materials science, such skills serve as fundamental tools to assist the design of technological materials and to explore new concepts to make new types of materials with innovative properties and functions.

**Polymer Engineering**

MEMTi has an extensive know-how in polymer science and technology, surface engineering, and formulation engineering. MEMTi specializes in sustainable flame retarded polymers, (nano) composites, tailor-made polymer compounds, functional nano-coatings, and bioregradable polymers for biomedical applications, for which modelling approaches are routinely employed.

**Biological and chemical-physical processes for environmental engineering**

MEMTi focuses on wastewater treatment and energy production from biomass processes. Biological and chemical-physical technologies are applied to remove nutrients and micropollutants in wastewaters and to convert organic matter into methane by means of anaerobic digestion. Feasibility studies as well as lab, pilot, and full-scale installations are carried out to test new processes.
### Student services

**Semester room**

Final year students can use a classroom equipped for individual and group study. This room can be accessed 24 hours a day, 7 days a week.

**Library**

The Department has a library that is part of the NEBIS system catalogue, a network of libraries and information centres in Switzerland. With its large collection of engineering and science books, the library provides users with various services, including inter-library loans.

- [www.supsi.ch/biblioteca](http://www.supsi.ch/biblioteca)

**mySUPSI**

The mySUPSI card for students, alumni and staff entitles holders to benefit from numerous special offers and discounts in Southern Switzerland.

- [www.supsi.ch/go/mysupsi](http://www.supsi.ch/go/mysupsi)

**Sport SUPSI/USI**

The Sport service promotes opportunities for students, teachers and employees to practice a wide range of physical and sporting activities.

- [www.supsi.ch/sport](http://www.supsi.ch/sport)

### Competence Centre for Languages and Studies on Plurilingualism

The Centre organises German and English language courses for SUPSI students, and Italian language courses for foreign students, with the aim of promoting student exchanges and facilitating graduates in their search for appropriate employment. The centre also manages two international examination centres: the Goethe-Institut Examination Centre of Southern Switzerland and the Cambridge Examination Centre of Southern Switzerland.

- [www.supsi.ch/centrolingue](http://www.supsi.ch/centrolingue)

**International Office**

The Service manages everything associated with the theme of internationalisation. It provides support for students, teachers and employees/associates who wish to spend time abroad. It also supports international students who come to SUPSI by welcoming and providing them with accommodation options.

- [www.supsi.ch/international](http://www.supsi.ch/international)

**Gender e Diversity**

This service raises awareness about gender, generational, cultural, and equal opportunities issues.

- [www.supsi.ch/gender](http://www.supsi.ch/gender)

**Counselling Service**

Counselling and psychological support services for those experiencing personal, interpersonal, emotional or social difficulties.

- [www.supsi.ch/ascolto](http://www.supsi.ch/ascolto)

### Centre for Start-Up Promotion

The Centre for Start-Up Promotion is supported by the Foundation for the Lugano Faculties of the Università della Svizzera Italiana (USI) in order to provide assistance to Swiss and foreign graduates, and in particular to those who plan to start up a business in Southern Switzerland. It aims to support innovative, entrepreneurial projects promoted by young graduates.

- [www.cpstartup.ch](http://www.cpstartup.ch)

### Student Life Service

The Career, Experience, and Orientation service (CEO) revolves around the students and their needs. It organises and coordinates strategic and management activities designed for career planning and development before, during and after university studies.

- [www.supsi.ch/ceo](http://www.supsi.ch/ceo)

**SUPSI Alumni**

The SUPSI Alumni Association brings together former SUPSI students. Members can use the website to access an information and networking platform. The SUPSI Alumni Office also proposes a series of career services: counselling and guidance, job offers, career development courses. Association members have access to a number of advantages, and can profit from numerous networking opportunities in their fields of interest.

- [www.supsialumni.ch](http://www.supsialumni.ch)

### Day Nursery

SUPSinido allows employees, associates and students to achieve a better work-life balance. The nursery can accommodate a maximum of 23 children, aged between 4 months and 3-4 years.

- [www.supsi.ch/nido](http://www.supsi.ch/nido)