



**School of  
Engineering**

**Master of Science  
in Engineering**





## Table of contents

5	Good reasons for studying for a Master of Science in Engineering degree
6	Graduate portrait: "More freedom to do what I want"
10	Industrial Technologies
12	Information and Communication Technologies
14	Energy and Environment
16	Business Engineering and Production
20	Specialisations in the field of construction and planning
21	Institutes and centres at a glance
22	Curriculum composition
23	Full-time and part-time study
23	International exchanges
26	An employer's perspective: How the MSE links research to practice
30	MSE at a glance





## Good reasons for studying for a Master of Science in Engineering degree

Opting for a Master of Science in Engineering (MSE) degree demonstrates that you want more. Are you considering an academic career and keen to develop your specialised knowledge? Do you want to enhance your job prospects immediately after completion of your bachelor degree? Did you earn your BSc degree some years ago and are now eager to acquire the qualifications for a more senior management role? If your answer to any of these questions is yes, then the MSE is the right choice for you.

The MSE programme is open to candidates that achieved an A or B grade in their Bachelor's degree. Gaining admission to this course and earning your MSE shows that you belong to this top third of students. Individual curriculum planning will enable you to arrange your studies to suit your personal interests or specific vocational objectives. In addition to in-depth technical knowledge, the MSE programme also teaches you key management skills that are essential to the advancement of your career.

Throughout your MSE studies you will be assigned to an institute or centre with extensive know-how in the specialised area you have chosen. These institutes and centres are constantly engaged in cutting-edge research projects in collaboration with business and industry. As a result, you will always be dealing with practically oriented tasks and solutions.

The curriculum is flexible. If you are already employed or have family duties, you can complete your MSE programme on a part-time basis. Cross-cultural skills are important to us, which is why many of our modules are conducted in English. Such skills can be further enhanced by spending an exchange semester abroad and even enrolling for an international double-degree programme. The flexibility of the curriculum therefore means that you are able to make choices that suit your specific circumstances.

### **The ZHAW School of Engineering offers master's degree programmes in the following six specialised areas:**

- Business Engineering and Production
- Energy and Environment
- Industrial Technologies
- Information and Communication Technologies
- Civil Engineering and Building Technology  
(in collaboration with the School of Architecture, Design and Civil Engineering)
- Spatial Development and Landscape Architecture  
(in collaboration with the School of Architecture, Design and Civil Engineering)

## “More freedom to do what I want”



Dominik Jäger earned his MSE at the ZHAW School of Engineering. Now he is employed at GeoPraevent AG in Zurich, where his work helps to ensure that people are better protected from natural hazards. Besides enabling him to study his specialised field in greater depth, the MSE has also given him greater professional freedom.

The lake on the Plaine Morte glacier, the river trench at the Grimsel Pass and the Trift Glacier in the Bernese Oberland all have one thing in common: if water, rock or ice were to be set in motion, the consequences for transport routes and populated areas could be severe. Disaster can be avoided by using sensitive measuring instruments that can predict flash floods and mudslides. One of the tasks of Dominik Jäger and his team is to develop such instruments, program them for their specific uses and install them in the terrain concerned. “I am fascinated by the sheer variety of the work. Although my main job is in software development, I am also involved in organising projects, dealing with customers and working on site.”

### **Combining theory and practice**

“Perhaps I am something of an idealist”, Dominik Jäger says of on himself. After completing his IT apprenticeship in Frauenfeld, his principal motivation for enrolling at the ZHAW School of Engineering was not the quest for career opportunities or higher pay. “I just wanted to know more. Even after earning my bachelor degree I still did not feel that I was ‘fully educated’.” Because it was also important to him to gain further professional experience, he decided to enrol for the Master of Science in Engineering (MSE) degree programme on a part-time basis. “I studied 50 percent and worked 50 percent as a scientific assistant at the Centre for Signal Processing and Communications Engineering. That combination of theory and practice was ideal for me. It enabled me not only to extend my knowledge but also to put some of it into immediate effect in my work.”

Roughly half of the modules Dominik Jäger completed during his MSE programme were conducted in English. That is also the language in which most technical literature used at the master's degree level is written. He is reaping the rewards from that experience today. "After Switzerland, the main market for our measurement instruments is China. As a result, I am often in contact with English-speaking customers, project coordinators and suppliers. My knowledge of English obviously helps me there." Of course, he adds, when it comes to working with people from other cultures, there is no alternative to acquiring experience by learning on the job. Over time, one becomes more confident in communicating across cultures. "The teaching I received during the MSE programme certainly provided me with a good basis", says Dominik Jäger, looking back.

#### **Management skills**

He regards the management skills he learned in the context modules he attended as equally important. As he puts it, "In my present position I am certainly not using everything I learned in those modules. Nevertheless, that part of the curriculum was certainly worthwhile. If, for example, I wanted to set up my own company or I wanted to patent an innovation, I could draw on the knowledge I gained from those courses." Not that Dominik Jäger is thinking of changing career track at present. "It is very important to me to be able to identify with my work and make a meaningful contribution. That is certainly the case now."

#### **A master's degree is becoming ever more important**

The value of a master's degree generally and an MSE degree in particular will increase further in the years ahead, Dominik Jäger believes. These qualifications still need to gain acceptance among the broad majority of Swiss firms. However, larger and internationally oriented companies already set store by them as a means of holding their own against their international rivals. "For me personally, the career advancement and higher pay is secondary. What really counts about my master's degree is that it gives me greater freedom. Freedom to do the work I want to do rather than the work I have to do."



*"That combination of theory and practice was ideal for me. It enabled me not only to extend my knowledge but also to put some of it into immediate effect in my work."* Dominik Jäger





Optimising a sub-process in the manufacture of flexible flat tops for textile carding





For his master's degree thesis in Industrial Technologies, Tobias Burkhard analysed, optimised and automated the manufacture of flexible flat tops. These flat tops are used in so-called carding machines, which untangle and partially clean textile threads prior to further processing.

## Industrial Technologies

By selecting Industrial Technologies (InT) as your area of specialisation, you will acquire the skills needed to work as a developer. You will gain an understanding of technological products and systems in their entirety and learn to analyse and define the interactions between a variety of technologies at the system level. You will formulate the criteria that a product or system needs to meet, work with the customer to define the necessary specifications and then choose the appropriate technologies and processes to meet those requirements.

### **InT comprises the following areas of competence:**

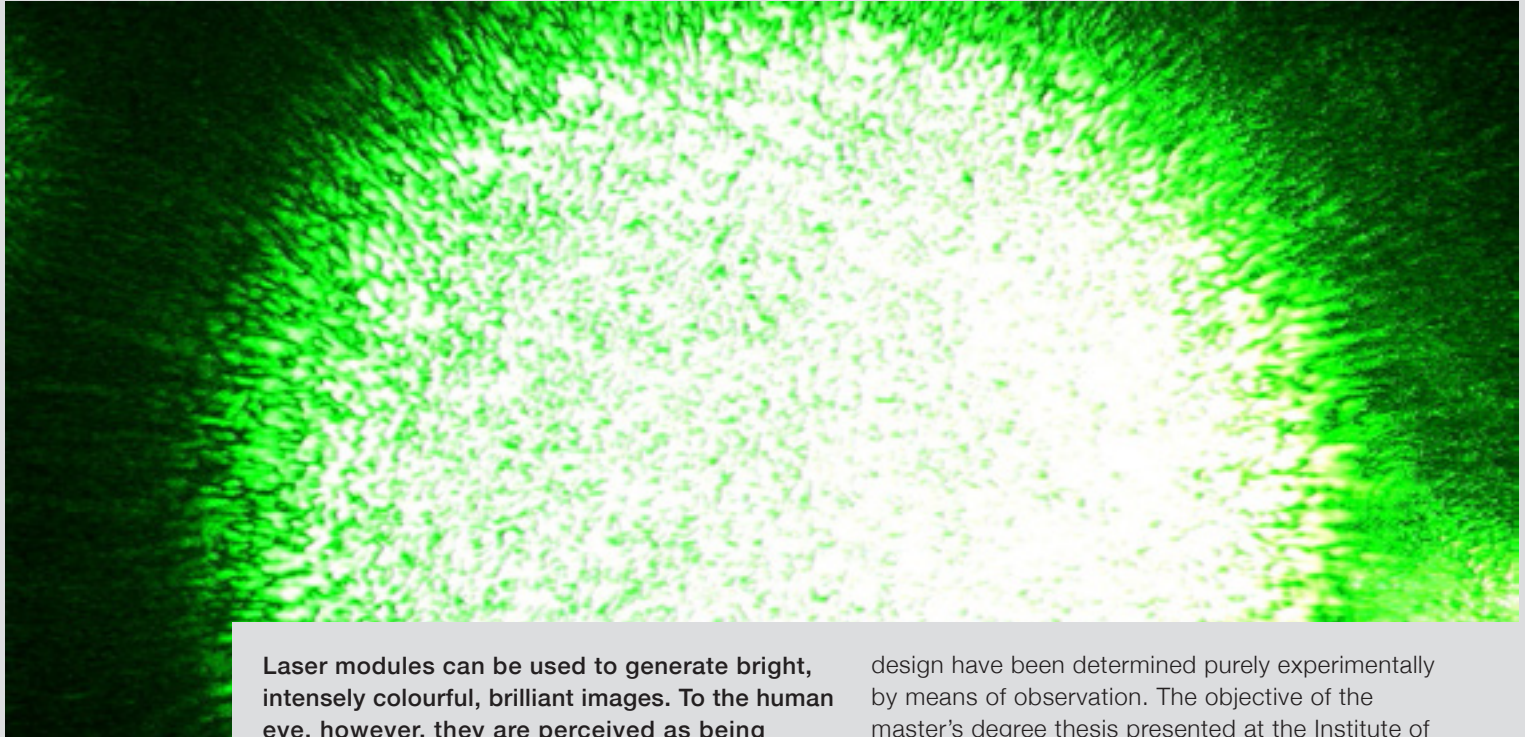
- Product Development and Production Technology: integral development of components, modules and entire machines from initial idea to implementation, including the development and implementation of economically viable manufacturing technologies based on secure processes
- Materials Technology: development of materials, material surfaces and appropriate methods for their manufacture, selection of materials suitable for a product and integration of such materials into the product manufacturing process
- Mechatronics and Automation: modelling, analysis, design and realisation of mechatronic components and systems
- Embedded Systems and Microelectronics: analysis, architecture, design and realisation of hardware and software for embedded micro-electronic systems

### **The following institutes and centres offer InT as a field of specialisation:**

- *Institute of Applied Mathematics and Physics (IAMP)*; research specialisations: applied optics, applied complex systems science, medical and biophysics, safety-critical systems, computational and algorithmic science
- *Institute of Energy Systems and Fluid Engineering (IEFE)*; research specialisations: renewable energy, energy storage, energy networks, energy efficiency
- *Institute of Mechanical Systems (IMES)*; research specialisations: biomechanical engineering, lightweight construction engineering, applied mechanics
- *Institute of Mechatronic Systems (IMS)*; research specialisations: robotics and automation, control engineering and advanced control, drive engineering and power electronics, biomedical engineering, system technology, vision and navigation
- *Institute of Computational Physics (ICP)*; research specialisations: multiphysics models and software, electrochemical cells and energy systems, organic electronics and photovoltaics, sensors and actuators
- *Institute of Embedded Systems (InES)*; research specialisations: functionally secure and dependable systems architecture, precise synchronisation and high-availability networks, wireless communications, system-on-chip field-programmable gate arrays
- *Institute of Materials and Process Engineering (IMPE)*; research specialisations: materials and surfaces technology, process development
- *Centre for Aviation (ZAV)*; research specialisations: aerodynamics and flight mechanics, human factors and aeronautical communication, systems integration and structural integrity
- *Centre for Product and Process Development (ZPP)*; research specialisations: innovation and product development, 3D tools and CAx technologies, additive and subtractive manufacturing
- *Centre for Signal Processing and Communications Engineering (ZSN)*; research specialisations: electronics and high-frequency technology, signal technology and wireless communication, digital signal processing



Master's thesis in Industrial Technologies  
helps to harness the full advantages of laser light



**Laser modules can be used to generate bright, intensely colourful, brilliant images. To the human eye, however, they are perceived as being patchy. A master's degree thesis carried out an in-depth analysis of the causes of this phenomenon with a view to finding ways of suppressing its undesired effects.**

Conventional light sources for cinema projectors have a limited lifespan of a few months, during which their light output diminishes along with the quality of the images they project. Replacing them with laser technology would therefore appear to make sense, as lasers have much longer useful lives and require virtually no maintenance. However, the packets of long-wavelength light sent out by the laser cause undesired interference effects, which the human eye perceives as patches or shimmering, veil-like structures. In head-up displays and barcode readers this same effect also results in an unacceptable loss of image or scan quality.

#### **Identifying the key parameters**

The visibility of these so-called speckles can be suppressed. This is achieved by using a diffuser, which blurs the disruptive speckle structure. The Laser Speckle Reducer (LSR), which is already marketed by the company Optotune, is one such device. To date, the key parameters used in its

design have been determined purely experimentally by means of observation. The objective of the master's degree thesis presented at the Institute of Applied Mathematics and Physics (IAMP) was to gain a fundamental understanding of the physical process behind the speckle phenomenon and to model it mathematically. The aim was to carry out a systematic analysis of the relevant parameters, thus making it possible to improve the existing product.

#### **From speckle model to a multiplicity of applications**

Modelling these speckle patterns has proved to be a highly calculation-intensive task. It has been necessary to calculate the trajectory of millions of wave packets on their journey from every point on the screen to the retina of the eye. As a result of that work, it has been possible to identify the initial key parameters for laser projectors and thus to answer the main initial questions relating to the design of the next generation of LSRs. Moreover, since it was this master's thesis that first demonstrated the complexity of the issues involved, it was subsequently possible to continue the research as part of a Commission for Technology and Innovation (CTI) project in conjunction with Optotune as the industry partner.



## Information and Communication Technologies

Information and communication technologies (ICT) encompass both information technology and telecommunication. As an MSE graduate specialising in this field, you will have acquired the skills needed to plan and create system architectures. You will be able to deploy simulation and modelling tools and use them efficiently and appropriately. You will also have the expertise required to implement comprehensive test scenarios for IT systems and components.

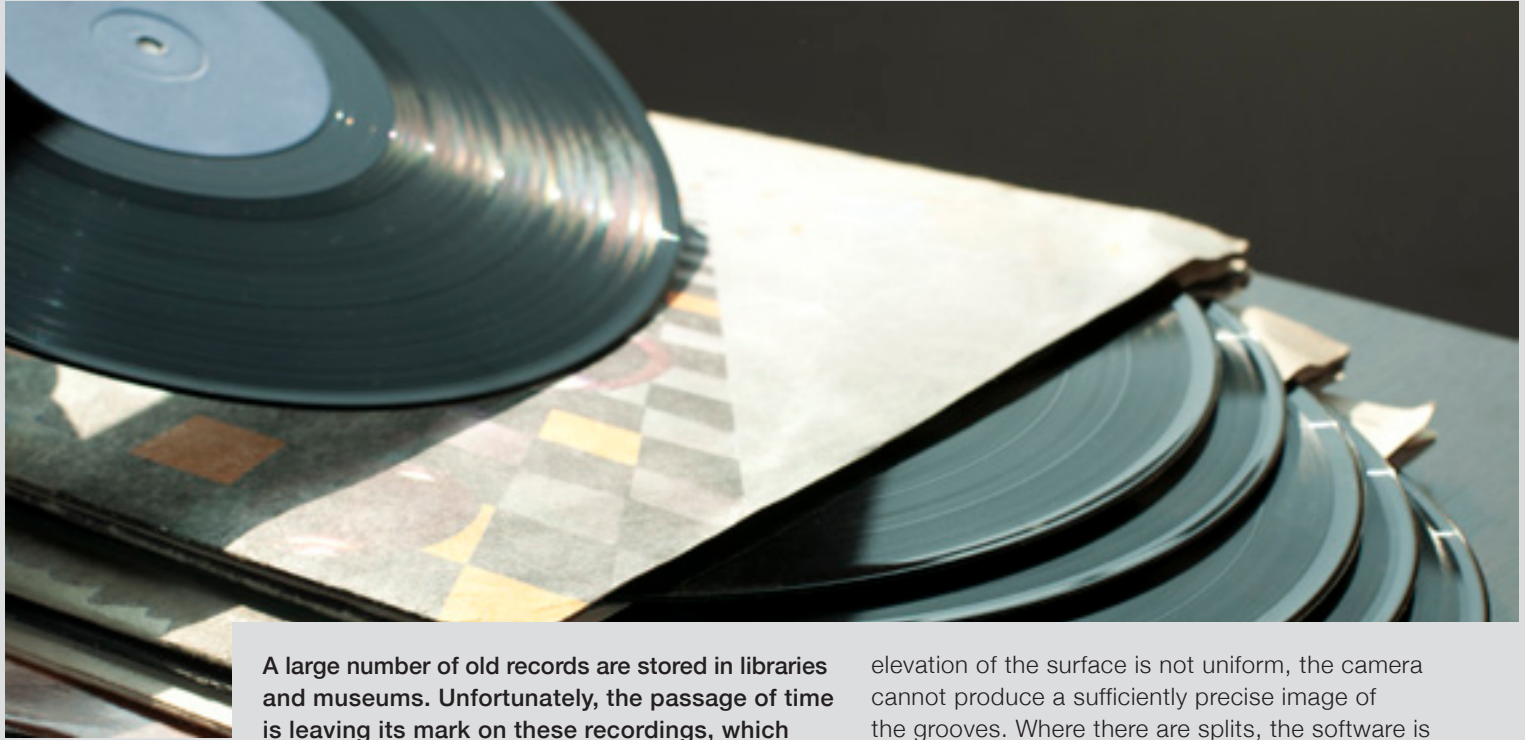
### **ICT comprises the following areas of competence:**

- Communications and Information Systems: modelling, planning, realisation and operation of secure and reliable communications and information systems, intelligent networks, embedded systems and mobile, pervasive and ubiquitous applications and devices
- Software Engineering and Technology: architecture, analysis, design, development, extension and testing of software systems which meet all user and software requirements and operate reliably, securely and efficiently
- Data and Information Management: modelling, retrieval, capture, configuration, consolidation, analysis, visualisation and management of data and information

### **The following institutes and centres offer ICT as a field of specialisation:**

- *Institute of Applied Information Technology (InIT)*; research specialisations: distributed software systems, human-information interaction, information engineering, information security, information infrastructure protection, service engineering
- *Institute of Embedded Systems (InES)*; research specialisations: functionally secure and dependable systems architecture, precise synchronisation and high-availability networks, wireless communications, system-on-chip field-programmable gate arrays
- *Centre for Signal Processing and Communications Engineering (ZSN)*; research specialisations: electronics and high-frequency technology, signal technology and wireless communication, digital signal processing

**Master's thesis in Information and Communication Technologies  
shows how broken records can be heard again**



**A large number of old records are stored in libraries and museums. Unfortunately, the passage of time is leaving its mark on these recordings, which are gradually becoming warped or cracked and thus unplayable. This master's degree thesis developed a refinement to an existing optical process for reading their content, which enables it to be digitalised and preserved.**

Until the 1950s the record was probably the most widely used audio recording medium and many historically significant sound documents were stored on them. However, as is becoming ever more apparent, they are not immune to the ravages of time. It is important, therefore, that records be digitalised so that the historical material they contain can be preserved for future generations. Thanks to the I.R.E.N.E. optical process, this is already possible today. Rather than being read mechanically, the record grooves are read optically. Once a special camera has created 2D images of the record's surface, the software then extracts the audio data from the images.

#### **Problems reading damaged records**

Quite often, however, this process does not work. Until now, automatic digitalisation of records which are warped, cracked or split into several pieces has not been possible. Because the

elevation of the surface is not uniform, the camera cannot produce a sufficiently precise image of the grooves. Where there are splits, the software is unable to process the gap between the two surfaces. It was precisely this problem that this ZHAW master's thesis, carried out at the Institute of Embedded Systems in collaboration with the Lawrence Berkeley National Laboratory in the United States, set out to address. Its stated objective was to develop a method which made it possible to digitalise damaged or warped records.

#### **Automatic and semi-automatic solution**

At the core of the project was the need to further develop the existing software. It is now able to handle blurs and close gaps in the recorded image. Because the software automatically identifies the continuation of a groove after a break, the digitalisation process can be significantly accelerated. Tests have demonstrated that the process is particularly reliable when used on records with minor cracks. When the damage to a record is more substantial, however, manual intervention is still required.

## Energy and Environment

Energy and Environment (EE) is a specialisation whose primary focus is on sustainability. The objective is to care for the environment and utilise natural resources economically. The curriculum teaches you to develop efficient processes which use resources sparingly and extends your specialised knowledge of energy, process and environmental technologies and of renewable energies.

### **Energy and Environment comprises the following areas of competence:**

- *Electrical Power Technology*: use of renewable electrical energy sources such as photovoltaics, fuel cells, storage, supply and utilisation of energy
- *Thermal Power Technology*: design, modelling, planning, implementation and operation of efficient systems for the conversion, storage, provision and utilisation of energy from sources such as wind power, heat pumps, etc.
- *Process Engineering*: design, layout, modelling, planning, implementation and operation of processes and systems
- *Environmental engineering*: analysis, modelling, planning and implementation of measures for addressing environmental problems affecting air, water and land, as well as in the area of process-integrated environmental protection

### **The following institutes and centres offer EE as a field of specialisation:**

- *Institute of Energy Systems and Fluid Engineering (IEFE)*; research specialisations: renewable energy, energy storage, energy networks and energy efficiency
- *Institute of Sustainable Development (INE)*; research specialisations: sustainable energy systems, sustainable transport systems, risk management and technology assessment
- *Institute of Computational Physics (ICP)*; research specialisations: multiphysics models and software, electrochemical cells and energy systems, organic electronics and photovoltaics, sensors and actuators
- *Institute of Materials and Process Engineering (IMPE)*; research specialisations: materials and surfaces technology, process development



Master's degree thesis in Energy and Environment  
uses mobile measuring device to make chillers operate more efficiently



**The energy-efficient operation of a chiller requires a precise knowledge of the actual strains to which the machine is exposed. The optimisation process thus begins with a measurement challenge. This is what the Mobile Chiller Analyzer is designed to meet. The device was developed as part of a master's degree thesis at the Institute of Energy Systems and Fluid Engineering.**

#### **A cooling technology challenge**

To ensure that food does not spoil, it needs to be stored in stable climatic conditions. The cold storage facility used by a wholesaler, for example, must always be maintained at the same interior temperature to ensure that meat or vegetables can be stored for long periods of time. This means that the chiller used to keep the cold-storage area at the same internal temperature has a demanding task to perform. When new food is delivered, everything has to be cooled as quickly as possible to prevent the goods already in storage from warming up. Even when the outside temperature increases, the temperature inside must remain constant.

#### **Energy consumption as a planning challenge**

Chillers are designed and built to be able to fulfil these tasks reliably. How much energy they use is a secondary consideration. The design process is focused almost exclusively on absolute reliability

and maximum performance load. In reality, however, these chillers rarely have to perform at this level. As a result, most of the machines in use today are not operating at their most efficient and optimal rate and are therefore using more energy than necessary.

#### **Measurement technology solution**

A master's degree thesis submitted at the Institute of Energy Systems and Fluid Engineering (IEFE) has carried out pioneering work in this area of energy-efficient cooling. The project has created a mobile measuring device and the software on which it operates. The device can be connected to any chiller to measure its actual degree of capacity utilisation. The data collected can then be used both to determine the performance-related metrics for a range of load scenarios and to gauge and evaluate the chiller's energy efficiency. The data-capture software developed as part of this project enables rapid, simple and partially automated preparation for the measuring process. Once the measurements have been carried out, concrete operating and planning recommendations can be made. As a result, chillers can be planned and operated to use energy more efficiently without jeopardising the reliability of their cooling performance.

## Business Engineering and Production

Business Engineering and Production (BEP) teaches a broad range of engineering methods designed to analyse operational structures and processes, to enhance them in a targeted fashion and to develop and distribute new products and services in accordance with defined criteria with regard to cost, efficiency, quality and sustainability. As a graduate from this programme, you will have the necessary skills to lead challenging projects both in Switzerland and abroad and will be qualified to assume management responsibilities.

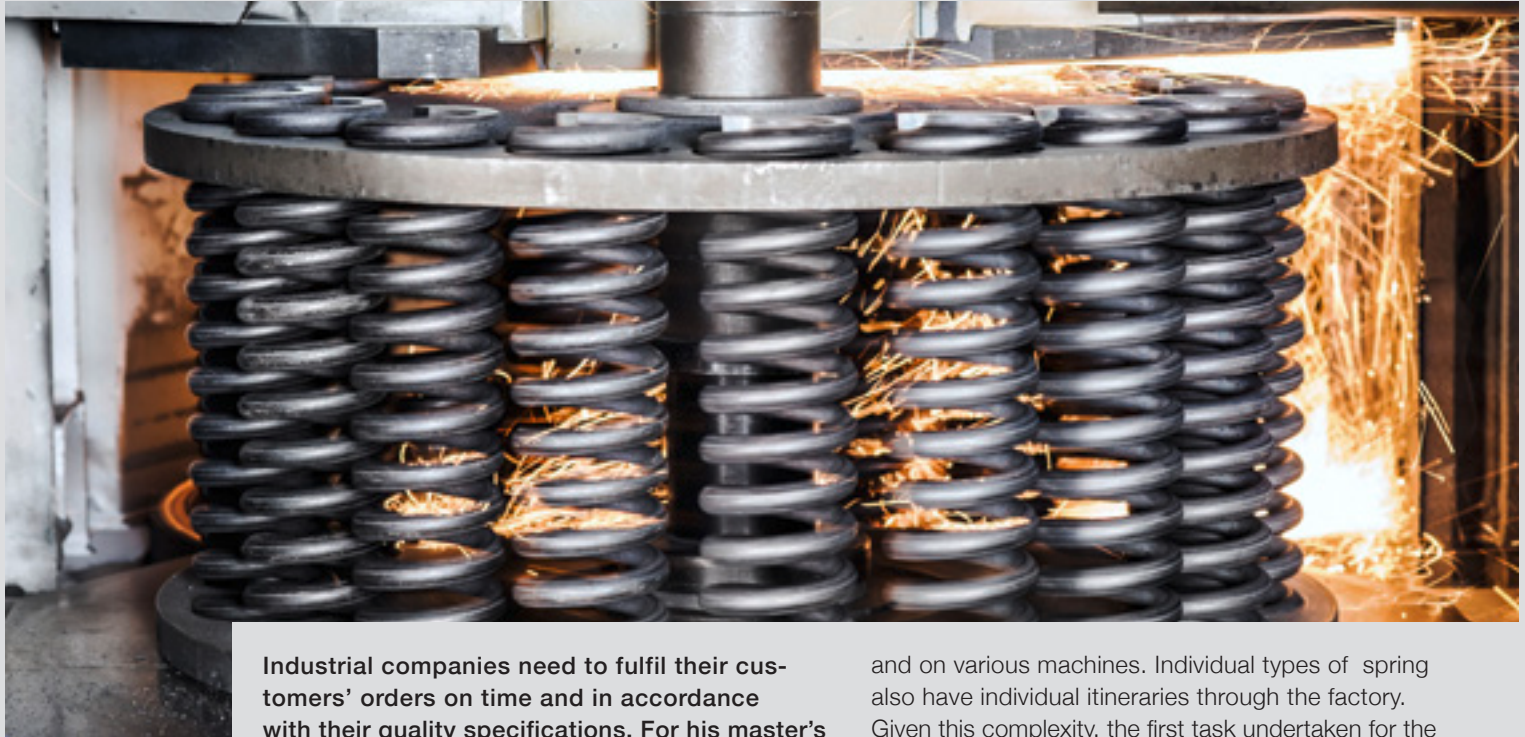
### **Business Engineering and Production comprises the following areas of competence:**

- Business Engineering and Operations Management: the focus here is on methods and concepts for the design and efficient management of industrial and service systems. You will gain the knowledge of operations management, risk management, business analytics and decision support theory required to deliver products and services in accordance with specific cost, availability and quality criteria. Graduates with this specialisation typically go on to work in the fields of materials management, supply chain management, production and operations in industrial or service companies or in a consultancy function.
- Product and Service Innovation: this specialisation teaches you the skills and knowledge required to develop, produce and distribute new products and services. You will learn the methods used for analysing and anticipating market trends and customer needs and for developing, producing, launching and continuously improving products and services. You will acquire the confidence to work effortlessly in international and interdisciplinary teams and to coordinate their activities. Your career prospects will be in the fields of product, service, portfolio and innovation management, consultancy or independent entrepreneurship.

### **The following institutes and centres offer BEP as a field of specialisation:**

- *Institute of Applied Mathematics and Physics*; research specialisations: applied optics, applied complex systems science, medical and biophysics, safety-critical systems, computational and algorithmic science
- *Institute of Data Analysis and Process Design (IDP)*; research specialisations: business engineering and operations management, data analysis and statistics, finance, risk management and econometrics, transport and traffic engineering
- *Institute of Sustainable Development (INE)*; research specialisations: sustainable energy systems, sustainable transport systems, risk management and technology assessment
- *Centre for Aviation (ZAV)*; research specialisations: aerodynamics and flight mechanics, human factors and aeronautical communication, systems integration and structural integrity

Master's degree thesis in Business Engineering and Production ensures springs are delivered to customers faster



**Industrial companies need to fulfil their customers' orders on time and in accordance with their quality specifications. For his master's degree thesis, Kadir Göçer developed, implemented and tested an algorithm for a company that manufactures springs. The algorithm is designed to plan the production schedules of the company's manufacturing plant.**

Federtechnik Kaltbrunn AG manufactures compression, extension and torsion springs. Most of the output is produced in small to medium-sized batches. Short production times and rapid customer delivery schedules are key competitive factors. However, these short production runs also involve labour-intensive reconfigurations of the production line and differences in throughput times. This makes the planning of the product runs, which is currently still carried out manually, a complex problem. Production-sequence planning determines when and in what order individual production orders are processed. This involves taking into account not only the setup and operating configuration of the production line but also the availability of tools and transport.

#### **Automated sequence planning based on priority rules**

During its manufacture, a spring goes through a number of work processes in various departments

and on various machines. Individual types of spring also have individual itineraries through the factory. Given this complexity, the first task undertaken for the thesis was to identify the bottlenecks in the production process, which were found to occur at the grinding stage. Automatic sequence planning was then used to subject this process to a high throughput load, based on a priority rules process. Six different priority rules were defined for this purpose. All can be implemented quickly and they are also transferable to other departments. The target criteria for the quality of the production plans were based on average order throughput time, average order delay time and the number of delayed orders.

#### **Implementation of the heuristic planning methodology at the grinding stage**

The priority rules process was implemented for production orders at the grinding stage. It was then tested against historical data for four different scenarios. The tests showed that the new process delivered better results than the previous operational planning method in terms of all the defined target criteria. Once the priority rules process was implemented, an interface to the production planning software was also created, thus enabling this methodology to be used in daily planning operations.





Digital processing of IMU signals for gait analysis





MSE graduate Christoph Rutishauser has developed sensors which can be fixed to a patient's shoe in order to analyse gait patterns and thus diagnose potential medical conditions.

Specialisations in the fields of construction and planning are also offered in conjunction with the School of Architecture, Design and Civil Engineering

**Civil Engineering and Building Technology**

The Civil Engineering and Building Technology (CEBT) specialisation broadens and deepens your knowledge in the field of construction. You will learn the skills needed for the interdisciplinary planning of complex building projects and how to manage them within strict schedule and cost parameters. In addition to constantly evaluating the use of new technologies, you will also acquire know-how in the fields of building conservation, sustainable building and natural risks.

**The following institute offers CEBT as a field of specialisation:**

– *Institute of Mechanical Systems (IMES)*

**Spatial Development and Landscape Architecture**

With an MSE specialising in Spatial Development and Landscape Architecture (SDLA) you will acquire the skills and expertise you need for the development, renewal and design of transport infrastructure and residential environments. You will be able to initiate, plan and supervise projects across technical disciplines, as well as conduct negotiations between public and private contracting entities, specialist contractors and the general public.

**The following institutes offer SDLA as a field of specialisation:**

– *Institute of Data Analysis and Process Design (IDP)*

– *Institute of Sustainable Development (INE)*



## Institutes and centres at a glance

Throughout your studies you will be assigned to an institute or centre with substantial know-how in your chosen field of specialisation. There you will work on research and development projects with clear practical objectives. Your choice of institute or centre will substantially determine the direction and focus of your studies, so it is important that you think carefully before making your final choice. At the ZHAW School of Engineering, the areas of specialisation are distributed among the various institutes and centres as follows:

Institute/Centre	Engineering				Construction and planning		
	BEP	EE	InT	ICT	CEBT	SDLA	Geo
Institute of Applied Mathematics and Physics (IAMP)		X	X				
Institute of Computational Physics (ICP)		X	X				
Institute of Data Analysis and Process Design (IDP)	X					X	
Institute of Sustainable Development (INE)		X				X	
Institute of Energy Systems and Fluid Engineering (IEFE)		X	X				
Institute of Embedded Systems (InES)			X	X			
Institute of Applied Information Technology (InIT)				X			
Institute of Materials and Process Engineering (IMPE)		X	X				
Institute of Mechanical Systems (IMES)			X		X		
Centre for Aviation (ZAV)	X		X				
Centre for Product and Process Development (ZPP)			X				
Institute of Mechatronic Systems (IMS)			X				
Centre for Signal Processing and Communications Engineering (ZSN)			X	X			

During your studies you will be supported by an advisor at your institute or centre who will advise you on the planning of your degree and will work with you in determining your choice of courses within your area of specialisation.

## Curriculum composition

Semester	Theory	Practice
1-2 (part-time: 1-4)	<ul style="list-style-type: none"> <li>– Extended theoretical foundations (fundamental theoretical principle modules) (9 ECTS)</li> <li>– Technical-scientific emphasis (technical-scientific specialisation modules) (6 ECTS)</li> <li>– Elective subjects (fundamental theoretical principle modules or technical scientific specialisation modules) (9 ECTS)</li> <li>– Context modules (6 ECTS)</li> </ul>	<ul style="list-style-type: none"> <li>– Specialisation: research and development projects (24 ECTS)</li> <li>– Complementary courses (at least 6 ECTS)</li> </ul>
3 (part-time: 5-6)	Master's degree thesis (27 ECTS)	

### Practice

The core of the MSE curriculum is your in-depth course of study at the institute or centre of your choice. This will provide you with the opportunity to extend and test the new specialised knowledge you have acquired in real industrial projects.

During their studies, MSE students generally work on three projects. In the first project, you will be a member of a development team. You will be given a concrete assignment and will receive expert supervision from a faculty member or an experienced research associate. In the second project, you will be responsible for the project design. The third project – your master's degree thesis – completes your studies. It demonstrates that you are able to independently carry out an extensive project that is demanding both from a methodological and a conceptual standpoint. It also demonstrates your ability to present your results both in writing and orally.

For your master's degree thesis you assume the role of a project leader and are largely responsible for the conceptual design of the project. Often you will be in charge of a small team that will be charged with carrying out component tasks within your master's degree project.

### Theory

In addition to practical skills, the MSE programme also provides its students with theoretical and contextual knowledge. Approximately 80 theoretical modules are available. With the help of your advisor you can choose those which are best suited to you. The context modules provide courses on company management, law, communication and international markets, thus providing you with some of the skills you will need in a future management role.

## Full-time and part-time study

The master's degree curriculum can be completed either on a full-time basis in three semesters or on a part-time basis in six semesters.

While the curriculum schedule is based on the academic calendar, individual project situations may result in some deviations from this. You can choose whether to commence your studies in the autumn or the spring semester.

Calendar Week	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
Tuition period																																																					
Tuition-free period																																																					
Exam session																																																					
Holidays																																																					
	Autumn semester																					Spring semester																															

## International exchanges

The ZHAW School of Engineering encourages its students to spend time abroad during their studies. A semester abroad at a partner university is a worthwhile experience that not only helps to improve your career prospects but also broadens your cultural horizon. It is also possible for students to carry out their master's degree thesis project abroad. Whether you work on your thesis abroad or in Switzerland, you will have the supervisory support of a ZHAW School of Engineering faculty member.

The ZHAW School of Engineering now also offers a two-year double-degree programme in conjunction with Washington State University (WSU). Under this arrangement, you complete your first year of study in Switzerland and your second year in the United States, during which time you also write your master's degree thesis.

Students completing this double-degree programme receive both a Swiss university of applied sciences degree and a university degree from the WSU. This means that you have full access to the US university system, including the possibility of writing a PhD in the United States.



Harnessing thermo-fluid dynamic simulation and modelling for development work on a new type of fuel-cell technology





Fuel cells use a complex set of physical and chemical processes. For his Energy and Environment master's degree thesis, Victor Lam applied holistic multiphysics simulation techniques to gain a better understanding of how these processes interact. These insights enabled him to carry out specific optimisations to the fuel-cell module.

## How the MSE links research to practice

With their master's degrees, MSE graduates are well placed to meet the challenges they will face in business and industry. Someone who knows what the employment market is looking for, what an MSE degree is worth in practice and what young professionals could do even better is Jürgen Braun, the head of Technology and Engineering at ABB Robotics Switzerland.

If you were entering the labour market with an MSE degree in your hand or were looking for a partner company with which to work on your master's degree thesis, you might well end up talking to this man. Jürgen Braun is the head of Technology and Engineering at ABB Robotics Switzerland. Through their work in programming industrial robots and developing complex manufacturing cells, he and his team have also supervised several master's degree theses written by students at the ZHAW School of Engineering. Jürgen Braun has a positive impression of the students he has met. As he explains, "They have in-depth knowledge of their specialisation and their master's degree thesis means that they have also gained experience in putting that knowledge into effect."

### **Qualified to take on more extensive tasks**

The knowledge advantage these students have is noticeable when they start their first job, Jürgen Braun believes. As he explains, "The MSE has earned itself a solid reputation over the last few years. A large number of candidates nowadays have a bachelor degree, so employers now see that as a minimum requirement. A master's degree, conversely, shows that an employee can be assigned to more extensive and complex tasks." These young professionals are particularly well suited to development work, which requires good analytical skills, in-depth technical knowledge and, above all, experience in practical applications.

### **Solution skills and pragmatism**

These are qualities which also set MSE graduates from a university of applied sciences apart from those with degrees from a university or the ETH (Federal Institute of Technology). "In my experience, theory and fundamental research are accorded a greater priority at the ETH. That is a good thing, because it gives rise to exciting new ideas", says Jürgen Braun. MSE graduates, on the other hand, are better at putting theory into practical effect. As he explains, "They are more likely to see that while an idea is good and exciting, it is simply not realisable in the context of day-to-day company operations." It is these solution skills and pragmatism, coupled with initial practical experience, that make MSE graduates attractive to future employers.

### Higher starting salaries

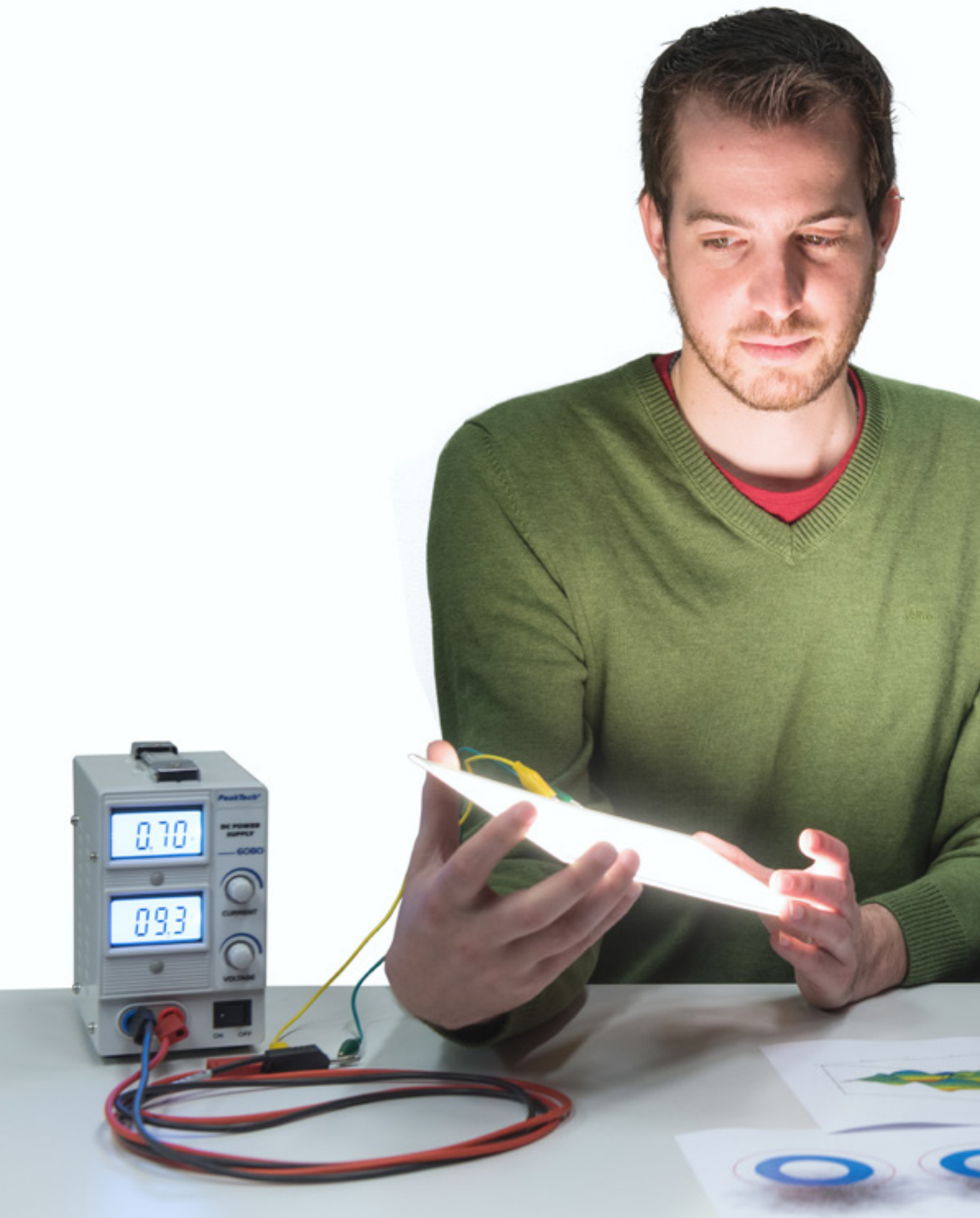
This is also reflected in salary levels. “Of course, I can’t speak for the industry as a whole, but at ABB we have a clear salary structure. Those who arrive with a master’s degree are placed in a higher category than those with a bachelor degree. They can also, depending on their position and performance, rise higher”, says Jürgen Braun. When it comes to career advancement, the management skills which the MSE teaches in its context modules are also important. “There is certainly no harm in paying more attention to these skills during university education”, Jürgen Braun believes. “For me it is important that, in addition to having the necessary technical knowledge, my staff are also able to put across their ideas and that they can make a presentation to a group of people with confidence, and without coming across as arrogant.”

### Greater personal initiative

ABB is certainly interested in further collaboration with ZHAW School of Engineering students working on their master's theses. “For us as a company, these collaborations not only represent a good opportunity of carrying out interesting projects, they also give us a chance of meeting potential future employees.”, says Jürgen Braun. He adds, however, that the pressure of day-to-day duties leaves little time for thinking about possible projects for students. That is why he would like to see even greater personal initiative from the students themselves. He also has another piece of advice. “Always try to think beyond the narrow confines of your studies. Personal commitment and interest are even more important than your thesis and your grade average. After all, in day-to-day professional life, what counts is not getting a project finished as soon as possible, but implementing it as effectively as possible.”



*“Always try to think beyond the narrow confines of your studies. Personal commitment and interest are even more important than your thesis and your grade average. After all, in day-to-day professional life, what counts is not getting a project finished as soon as possible, but implementing it as effectively as possible.”* Jürgen Braun



Calculation of light-scattering distribution functions based on Fourier and microfacets methods for 3D texture





For his master's degree thesis in Information and Communication Technology, Kevin Lapagna set out to develop software modules able to calculate the light dispersion characteristics of rough surfaces. These surfaces are used in the manufacture of organic solar cells and LEDs and can significantly enhance the efficiency of the components.

## MSE at a glance

### Degree title

Master of Science in Engineering ZFH  
specialising in (chosen specialisation)

### Scope

90 ECTS credits

### Duration

3 semesters (full time)  
6 semesters (part time)

### Course structure

The course is offered on a full-time and a part-time basis.

### Commencement of studies

Autumn or spring semester

### Application deadline

End of October and end of April  
(or by arrangement)

### Teaching venues

Theoretical modules are primarily taught in Zurich and Bern. They can also be attended in Lausanne and Lugano. Specialisation modules are taught in Winterthur.

### Language of instruction

German or English, depending on the module.

### Course fees

A number of charges are payable prior to and during the course of study. These include the enrolment fee and the semester fees.

### Specialisations

Business Engineering and Production / Energy and Environment / Industrial Technologies / Information and Communication Technologies / Civil Engineering and Building Technology / Spatial Development and Landscape Architecture.

### Admission criteria

Students with a good bachelor degree (grade A or B) will be invited to attend an admission interview. The programme director may also invite applicants to interview without these final grades on the basis of other relevant experience, provided that they present good overall bachelor degree grades.

### Admission interview

An interview will be conducted by the applicant's chosen institute or centre to determine his or her suitability for in-depth study in the relevant specialisation. Admission is granted to applicants who meet the admission criteria and successfully complete their interview at their chosen institute or centre.

### Contact

Degree programme secretariat  
Phone +41 58 934 82 43  
[mse.engineering@zhaw.ch](mailto:mse.engineering@zhaw.ch)





## School of Engineering

Technikumstrasse 9  
CH-8400 Winterthur  
Switzerland  
Phone +41 58 934 73 33

[info-sg.engineering@zhaw.ch](mailto:info-sg.engineering@zhaw.ch)  
[www.zhaw.ch/engineering/mse/en](http://www.zhaw.ch/engineering/mse/en)  
[facebook.com/engineering.zhaw](https://facebook.com/engineering.zhaw)

### Institutes and centres

Institute of Applied Information Technology (InIT)  
[www.zhaw.ch/init/en](http://www.zhaw.ch/init/en)

Institute of Applied Mathematics and Physics (IAMP)  
[www.zhaw.ch/iamp/en](http://www.zhaw.ch/iamp/en)

Institute of Data Analysis and Process Design (IDP)  
[www.zhaw.ch/idp/en](http://www.zhaw.ch/idp/en)

Institute of Energy Systems and Fluid Engineering (IEFE)  
[www.zhaw.ch/iefe/en](http://www.zhaw.ch/iefe/en)

Institute of Mechatronic Systems (IMS)  
[www.zhaw.ch/ims/en](http://www.zhaw.ch/ims/en)

Institute of Mechanical Systems (IMES)  
[www.zhaw.ch/imes/en](http://www.zhaw.ch/imes/en)

Institute of Sustainable Development (INE)  
[www.zhaw.ch/ine/en](http://www.zhaw.ch/ine/en)

Institute of Computational Physics (ICP)  
[www.zhaw.ch/icp/en](http://www.zhaw.ch/icp/en)

Institute of Embedded Systems (InES)  
[www.zhaw.ch/ines/en](http://www.zhaw.ch/ines/en)

Institute of Materials and Process Engineering (IMPE)  
[www.zhaw.ch/impe/en](http://www.zhaw.ch/impe/en)

Centre for Aviation (ZAV)  
[www.zhaw.ch/zav/en](http://www.zhaw.ch/zav/en)

Centre for Product and Process Development (ZPP)  
[www.zhaw.ch/zpp/en](http://www.zhaw.ch/zpp/en)

Centre for Signal Processing and Communications Engineering (ZSN)  
[www.zhaw.ch/zsn/en](http://www.zhaw.ch/zsn/en)