

FH UPPER AUSTRIA
LINZ CAMPUS

Winter School in Medical Engineering 2019

Key Areas: Prosthetics, Materials and
Medical Simulations

11 - 15 February 2019

University of Applied Sciences Upper Austria
School of Medical Engineering and Applied Social Sciences Linz/Austria

www.fh-ooe.at/mt-en



**UNIVERSITY
OF APPLIED SCIENCES
UPPER AUSTRIA**

Winter School in Medical Engineering 2019

Key Areas: Prosthetics, Materials and Medical Simulations

The Department of Medical Engineering and International Office of the University of Applied Sciences Upper Austria in Linz are pleased to welcome you to our second Winter School, offering you a 5-day programme of lectures, workshops, laboratory and cultural activities.

This year we focus again on Medical Simulations, Materials and Prosthetics. Today's prostheses are highly sophisticated products designed not only to replace an absent limb physically, but also to significantly improve the quality of life of their wearers.

The implementation of special sensor technologies has heightened the precision and accuracy of any movement, while embedding easily programmable microcontrollers has increased the range of complex movement patterns; in addition, special material technologies have reduced the weight of prostheses considerably.

However, a multitude of testing and simulation procedures is necessary before individuals in need can benefit from these technological innovations in prosthetics in their daily lives.

We sincerely hope that you enjoy your stay with us while also finding some time to discover Linz – it is the third largest city in Austria and the capital of the Province of Upper Austria.

For further information and registration please visit:
www.fh-ooe.at/winter-school-mt



FH-Prof. DI Dr. Martin Zauner MSc
Head of Department of Medical Engineering



Mag. Iwona Hunstorfer
Head of International Office

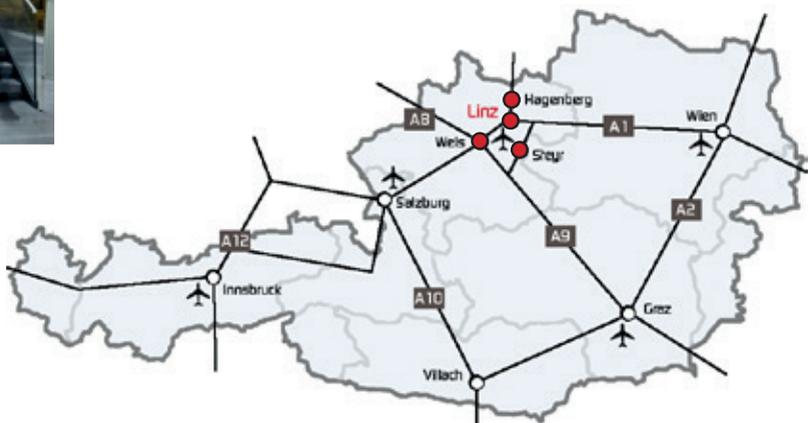


University of Applied Sciences Upper Austria (FH Upper Austria)

The University of Applied Sciences Upper Austria is the largest university of applied sciences in Austria and is an integral part of the tertiary education system. The organisation is defined by the requirements of regional employment and research needs. Four locations in Upper Austria's central area offer innovative and interdisciplinary academic degrees, each with a different focus.

- >> School of Informatics, Communications and Media
Hagenberg Campus
- >> School of Medical Engineering and Applied Social Sciences
Linz Campus
- >> School of Management
Steyr Campus
- >> School of Engineering
Wels Campus

You will find more information at:
www.fh-ooe.com



School of Medical Engineering and Applied Social Sciences

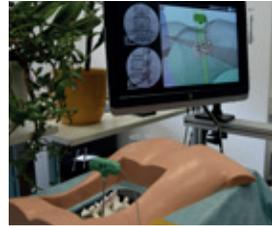
The focus in Linz is Medical Engineering and Applied Social Sciences. Our aim is to prepare students for the leadership positions of the future. Because our programmes are designed around a common theme, the synergy effects are obvious: more knowledge, and a multitude of partner organizations, such as the Austrian Red Cross, leading charities and numerous human services organizations and companies such as Otto Bock.

All degree programmes combine comprehensive training with practice. The School of Medical Engineering and Applied Social Sciences offers study programmes at undergraduate (bachelor's) and graduate (master's) level.

Medical Engineering combines medicine and medical device technology, and prepares students to bridge the gap as Medical Engineers.

The course of study for a degree in **Social Work** trains students to advise and counsel people in distress, and enables graduates to plan and organize the helping process.

Human Services Management focuses on the business skills graduates need to work in organizations in the social services field. The programme in **Public Management** combines business administration, accounting, controlling, business information systems, law, and public finance.



Programme

Monday, 11 February 2019

- 09:00 Introduction FH Upper Austria and Medical Engineering
- 09:15 Organizational Matters
- 09:45 Coffee and FH Campus Tour
- 11:00 Additive Manufacturing and Sample Analysis (Lecture)
- 13:00 Lunch Break - Sandwich Day
- 14:00 Additive Manufacturing and Sample Analysis (Workshop)
- 17:30 Welcome Dinner

Tuesday, 12 February 2019

- 09:00 Inertial Measurement Units for Prosthetics (Lecture)
- 12:30 Lunch Break - Pizza Day
- 13:30 Healthy Spine - Are you sitting correctly? (Workshop)

Wednesday, 13 February 2019

- 09:00 Simulating spatiotemporal immune signalling (Lecture)
- 10:00 Break
- 10:15 Tuning Tissue Mimicking Phantoms Properties in the Development of Viscoelasticity Characterization Techniques in Medical Imaging (Lecture)
- 11:15 Break
- 11:30 High-tech Limb-Prostheses (Lecture)
- 13:00 Lunch Break - Schnitzel Day
- 13:45 Visualisation of EMG-Signals which control Myo-Prostheses (Workshop)
- 15:30 Break
- 15:45 Guided Tour "Kepler Universitätsklinikum Med Campus III"
Hybrid Operation Laboratory for heart surgery with robot based Imaging

Thursday, 14 February 2019

- 09:00 Myoelectric Control of Hand-Prostheses (Lecture)
- 11:15 Break
- 11:30 Myoelectric Control of Hand-Prostheses (Laboratory)
- 12:30 Lunch Break - Sandwich Day
- 13:30 Myoelectric Control of Hand-Prostheses (Laboratory)
- 16:15 Break
- 17:00 "Ars Electronica Center"
"Deep Space 8K - Best of Ars Electronica"
Highlight Guided Tour

Friday, 15 February 2019

- 09:00 Bus pick-up from FH Upper Austria
- 09:30 Archery - Sports Centre Breitenstein
- 12:00 Lunch
- 14:30 Guided Tour: Brewery Freistadt
- 16:30 Bus trip back to Linz
- 17:00 Farewell Dinner

Lectures and Workshops

Monday, 11 February 2019

Prof. Dr. Jaroslav Jacak

University of Applied Sciences Upper Austria (Austria)

Additive Manufacturing and Sample Analysis (Lecture + Workshop)

The modern laboratories in Linz offer a variety of techniques for nanolithography as well as microscopical sample characterisation. In our laboratories, you will get a deeper understanding of techniques like multiphoton lithography, mask less lithography, fluorescence microscopy, atomic force microscopy and spectroscopy. Moreover the laboratory is equipped with an cell culture, equipment for molecular protein and genome analysis as well as advanced equipment for surface characterization. We are using these techniques in several projects applying them for example to analyze aggregation of thrombocytes, for arteria biomimetic etc. Recently, we offer trainee position in several practical courses and experimental bachelor and master works.

Tuesday, 12 February 2019

Prof. Dr. Thomas Haslwanter

University of Applied Sciences Upper Austria (Austria)

Inertial Measurement Units for Prosthetics (Lecture) -
Healthy Spine - Are you sitting correctly? (Workshop)

Position and orientation of human subjects (and also of objects like your smartphone) can be measured in different ways: one can use accelerometers, gyroscopes, magnetometers, optical systems, or a number of other devices. Unfortunately, cheap devices are often rather inaccurate, so that a combination of them has to be used in order to achieve reliable results.

In this course we will first introduce the basic measurement devices used for human movement recordings. Then the mathematical foundations required to measure position and orientation will be covered, such as rotation matrices and quaternions.

The accompanying workshop will provide a hands-on experience of working with data from inertial measurement units. Depending on the background of the participants, data will be analysed using Python and/or Matlab. To ensure success in the analysis, routines will be provided that implement the basic analysis steps for the evaluation of the recorded data.

Wednesday, 13 February 2019

Dr. Tino Frank

Lucerne University of Applied Sciences and Arts (Switzerland)

Simulating spatiotemporal immune signalling (Lecture)

Immune Signalling is a complex and highly orchestrated spatiotemporal signalling process. Building mathematical models of immune events such as cell migration or start of inflammation helps us to understand the dynamic nature of these processes. Further such quantitative models help us to predict behaviour, develop experimental platforms and test mechanisms for drug development. In the first part of the lecture, we will discuss how modelling immune cell environments allows development of microfluidic cell migration devices and its application for quantitative studies of T-Cell homing. On the case of CD19/21 gradients we will explore, that in-vivo experiments need to be accompanied by in-vitro experiments and how modelling helps to understand how chemotaxis is controlled. Further, it will be shown, how these models are linked to research for multiple sclerosis and its possible diagnostic applications.

The second part of the lecture will deal with innate immune reactions, like inflammation. Quantitative models of the key regulator NF- κ B signalling pathway will be used to demonstrate how immune reaction orchestration is controlled over time and space in our body. We will discuss, how cell signalling can synchronise and how information in the shape of a cytokine wave or spatially defined zones of gene expression is created by the signalling pathway. We discuss how such an environment can be built in a microfluidic device by simulating the process. Finally, we use this spatiotemporal model to simulate how chronic inflammation can occur and possible cures can be derived from the model.

Dr. Etienne Mfoumou

Nova Scotia Community College (Kanada)

Tuning Tissue Mimicking Phantoms Properties in the Development of Viscoelasticity Characterization - Techniques in Medical Imaging (Lecture)

Biomechanical properties are strongly correlated with tissue health allowing the diagnosis and characterization of diseased tissue. Out of several mechanical properties of tissue, viscoelasticity is of interest because it enables physicians to differentiate between healthy and diseased tissue. Many imaging techniques currently quantify the elasticity of tissue but assessing the progression and regression of diseases is of huge importance. This requires methods with spatial resolution of at least 100 μ m, unlike current techniques which have spatial resolutions on the order of millimeters. The proposed lecture will explore the use of tissue mimicking phantoms in the development of ultrasoundbased imaging techniques for non-invasive viscoelasticity characterization of biological tissue.



Lectures and Workshops

Wednesday, 13 February 2019

Prof. Dr. Hubert Egger

University of Applied Sciences Upper Austria (Austria)

High-tech Limb-Prostheses (Lecture)

A prosthesis is an artificial device that replaces a missing body part, which may be lost through trauma, disease, or congenital conditions. Prosthetic amputee rehabilitation is primarily coordinated by a prosthetist and an inter-disciplinary team of health care. Students attending the Winter School acquire theoretical knowledge with respect to basics in Anatomy, Physiology, Biomechanics, Electrical Engineering and Electronic Systems.

The course contributes to improved knowledge and understanding in prosthetic limbs.

Visualisation of EMG-Signals which control Myo-Prostheses (Workshop)

Based on the theory EMG-Signals will be picked up by surface electrodes from the student's forearm. Signals are then gained by amplifiers developed at the University of Applied Sciences to make them visible and audible. Additional signal-processing make the signals suitable to control artificial limbs performed in the Lab.

Thursday, 14 February 2019

Prof. Dr. Andreas Schrempf

University of Applied Sciences Upper Austria (Austria)

Myoelectric Control of Hand-Prostheses (Lecture + Workshop)

Within this course students will learn to implement a control strategy for a hand prosthesis by means of forearm muscle contractions. In the lecture the basic principles will be discussed and then in turn realized in the laboratory. The implementation of the control strategy will be programmed in C and tested first with the help of Matlab/Simulink. Once the control algorithm works as expected, the implementation will be transferred to the hardware, where students can test their implemented control strategy with their own EMG-signals to operate a real hand prosthesis. The learning outcome of that course includes the following topics: basic filtering techniques for EMG signals, implementation of a control strategy in C by means of a state machine, testing in Matlab/Simulink, transferring a C code to a target hardware platform, acquiring EMG-signals from the forearm, controlling a real hand prosthesis.

Cultural Events - Technics, Sports and Brewery Adventure

Thursday, 14 February 2019

Ars Electronica Center

The Ars Electronica Center is a place of inquiry and discovery, experimentation and exploration, a place that has taken the world of tomorrow as its stage, and that assembles and presents influences from many different ways of thinking and of seeing things. Join us for a “highlight guided tour” and before that experience the “Deep Space 8K” - a 16 by 9 meters wall and 16 by 9 meters floor projection, laser tracking and 3-D animations. An all-out upgrade of the venue’s technical infrastructure of the Deep Space will enable audiences to enjoy projections at 8K resolution and thus worlds of imagery at a never-before-achieved level of quality.



Friday, 15 February 2019

Archery Sports Centre Breitenstein / Kirchsschlag

Kirchsschlag is a small municipality in the northern part of Upper Austria. Spend with us a few hours there with delicious food in a typical Austrian restaurant and join us for maybe your first hunting adventure at the Archery Sports Center Breitenstein. Practised archers can embark on the course immediately and independently and beginners can do so with rental bows after a short introduction. You will shoot at different 3D animals. In the last few years, the Bogensportzentrum Breitenstein has established itself as one of the largest archery centres in the German-speaking area. With a 150-m²—sized archery hall open 24/7, three different 3D courses with more than 68 3D targets



Brewery Freistadt

Freistadt’s history can not be imagined without the brewing community. The Habsburg Duke Rudolf IV granted the brewing license to the citizens of Freistadt in 1363. At first beer was brewed in different houses, but after some time they joined forces by creating the first early form of today’s inns. Little by little the citizens united into larger brewing groups, finally there was only one wheatbeer and one brown beer brewery left in the city. In 1746 the township acquired all brewing licenses. They founded the “brewing community” (Braucommune), in which 149 house owners from the old town have been and still are the owners of the brewery together. The brewing community proved its importance for the city outwardly by building a common brewery, which was inaugurated in 1777 and has been the place of business for the city’s most important company. Find out more during our guided tour and join us for a beer tasting.

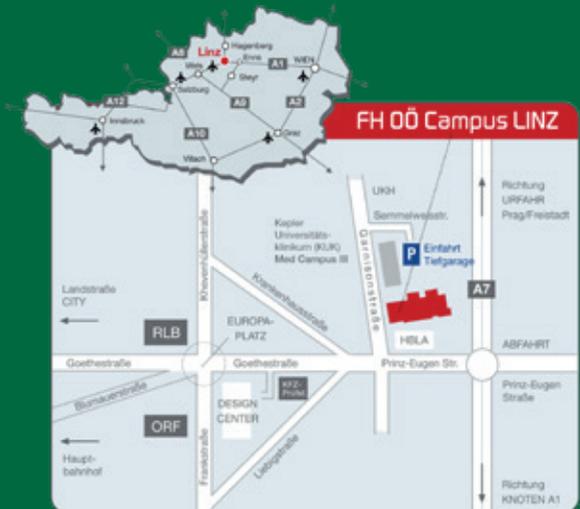




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