



# HUTON

## Mechatronics in rehabilitation

Assisting humans with special needs:  
Curriculum for **HU**man-**TO**ol  
interaction **Net**work (**HUTON**)

<http://huton.org>



# Presentation

- Basic information
- Structure
- Goals / objectives
- Subjects – structure
  - Subject information
  - What to students get? (for program and subjects)

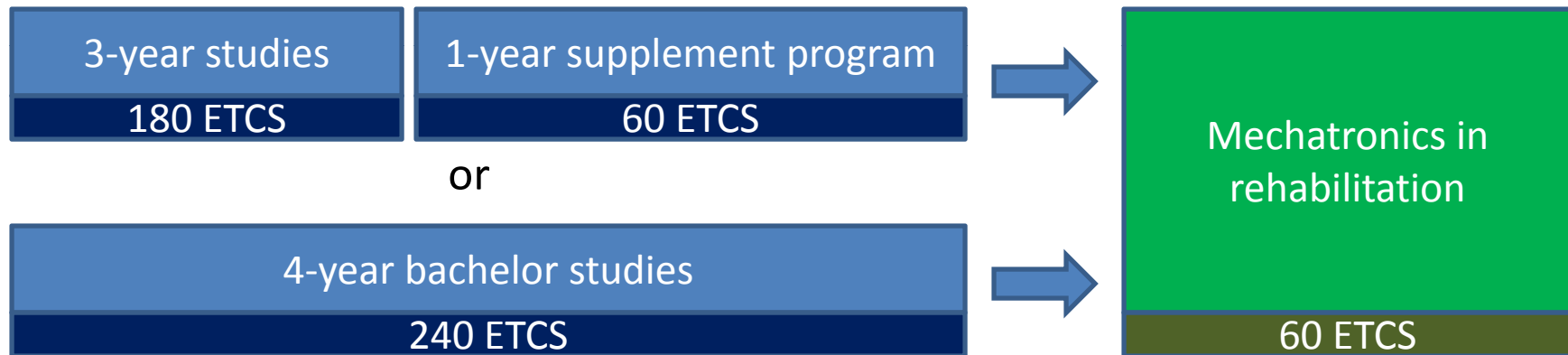


# Basic information

- Interdisciplinary program
- Background:
  - Life science (medical, social, human, rehab, natural science)
  - or
  - Technical sciences (electrical, machine, technological)
- Degree: Master of Science
- Duration: 1 year
- ECTS points: 60



# Structure





# Objectives

- Contribution to the construction of modern and efficient health care system
- Training of the staff for providing on-the-job education
- Training of the staff for providing better medical services for humans with special needs
- Setup of the training network in the domain of Mechatronics, rehabilitation engineering and medicine

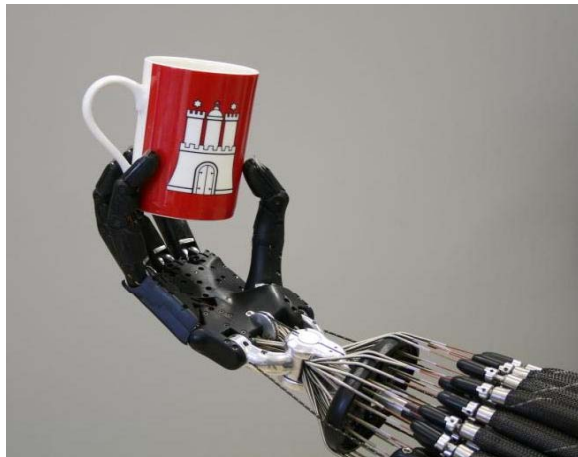


# Objectives

- Students will be able to:
  - design models for applying mechatronics in rehabilitation and their integration in real systems
  - choose the best, most effective rehabilitation system for better and higher level therapy

# Subjects - mandatory

1. Mechatronic systems
2. Control of movements in humans
3. Disability assessment methods
4. Signals and systems in rehabilitation



# Mechatronic systems

- Goal:
  - Mastering the knowledge required for competent analysis of the structure of mechatronic solutions
  - Defining the sensor part
  - The executive mechanism
  - Control modules and algorithms
- Students will obtain:
  - Development of creative skills to understand a given problem and set a preliminary mechatronic solution that will in an optimal way meet defined technical requirements







# Control of movements in humans

- Goal:
  - Introduction to the organization of human sensory motor system
  - Introduction to controlling arm movements, standing and walking
  - Introduction to basic pathological conditions caused by injury or disease of the central/peripheral nervous system, muscular system and changes in the skeletal system
- Students will obtain:
  - Knowledge of human sensory-motor system



# Disability assessment methods

- Goal:
  - Mastering the knowledge needed for understanding rehabilitation process in humans with functional disability
  - Development of creative ability to choose the best functional assessment for specific rehabilitation problem or therapeutic method
- What will students gain:
  - Development of ability to choose the best functional assessment for specific rehabilitation problem or therapeutic method

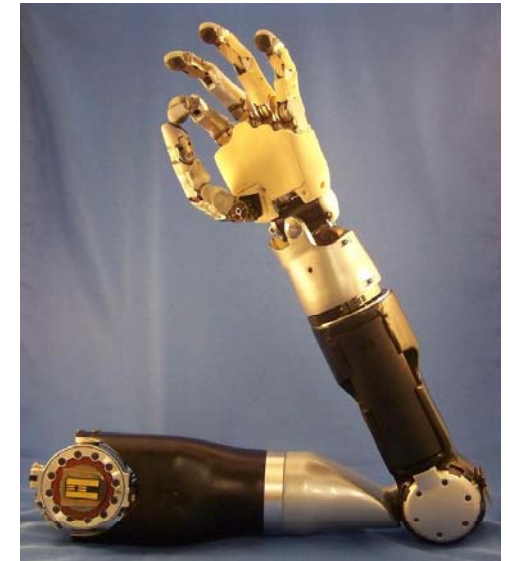


# Signals and systems in rehabilitation

- Goal:
  - Introduction to the basic principles of the human organism functioning
  - Introduction to the characteristics of the signals to be measured in rehabilitation and in assessing the state of patients recovery
  - Introduction to the principles of operating of motor and sensory neural prosthesis and robotic systems in rehabilitation
- What will students gain:
  - The knowledge of characteristics of the signal to be measured in rehabilitation and in assessing the state of the patients recovery

# Subjects - elective

1. Mechanics of Robots
2. Control for Man-Machine Systems
3. Pneumatic and Hydraulic actuators
4. Electrical and Magnetic Actuators
5. Sensors for Mechatronic Systems
6. External control of biological actuators
7. Human movements assessment
8. Scientific research methods in rehabilitation
9. Robotics for rehabilitation
10. Biostatistics
11. Microcomputers



# Mechanics of robots

- Goal:
  - Introduction to basics terms and definitions of mechanics as a science of movement and forces
- What will students gain:
  - Understanding of which forces occur in movement of robotic system
  - Recognizing different effects of their activity





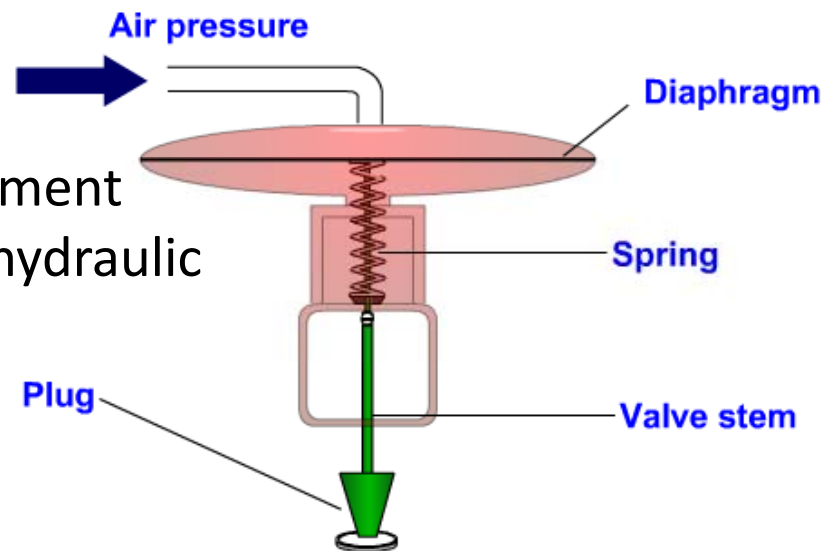
# Control for Man-Machine Systems

- Goal:
  - Applying basic knowledge for choosing the optimal control system
- What will students gain:
  - Knowledge of principles of how control systems work and the way of usage of specific computational packages for their design

# Pneumatic and Hydraulic actuators

- Goal:
  - To obtain all of the necessary knowledge for the development and calculation of pneumatic and hydraulic installations
  - Display all symbols in both fields
  - The use of hydraulic and pneumatic components as the engine of modern machinery in different areas of technology
  - The use of pneumatics and hydraulics to the specific conditions of development of medical devices. Regulations and standards

- What will students gain:
  - Necessary knowledge for development
  - and calculation of pneumatic and hydraulic installations





# Electrical and Magnetic Actuators

- Goal:
  - Mastering the fund of knowledge required for competent analysis of choice and application of electric and magnetic actuators
  - Getting to know the structure of the electric and magnetic actuators, features of work and their control
  - Development of creative ability to understand a given problem and set a proper solution that will in an optimal way meet specified technical requirements for the application of electric and magnetic actuators
- What will students gain:
  - Students will acquire the necessary knowledge for a competent analysis of choice and application of electric and magnetic actuators





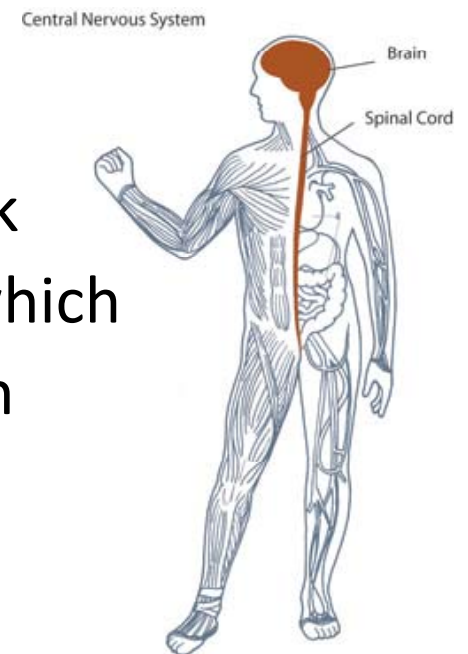


# Sensors for Mechatronic Systems

- Goal:
  - Introduction to the basic principles of the sensors based on the principles of energy conversion from one form to another
  - Enable students to apply basic knowledge for optimal selection of methods for energy conversion, i.e. the appropriate choice of sensors in mechatronic systems
  - Prepare students to work in a multidisciplinary research
- What will students gain:
  - Students will gain knowledge of the basic principles of sensors and appropriate choice of sensors in mechatronic systems

# External control of biological actuators

- Goal:
  - Learning that allows efficient implementation and selection of a suitable system for rehabilitation based on knowledge of the changes caused by the lesion and effects that have electric and magnetic field on the body
- What will students gain:
  - Knowledge that guarantees safety at work and optimization of application of system which bridges and replaces missing mechanisms in central nervous system after lesion





# Human movements assessment

- Goal:
  - Getting to know the measurement instrumentation and methods for signal processing intended for evaluation of motor skills and abilities of patients for movement
  - Enabling the student to record the signals of interest in the clinical and laboratory conditions for objectification state of recovery and assessment of treatment effects
  - Mastering the art of correct selection of the measuring equipment or the development of special purpose measuring system for use in evaluation of the rehabilitation effects
- What will students gain:
  - Gain the knowledge for robot application in rehabilitation



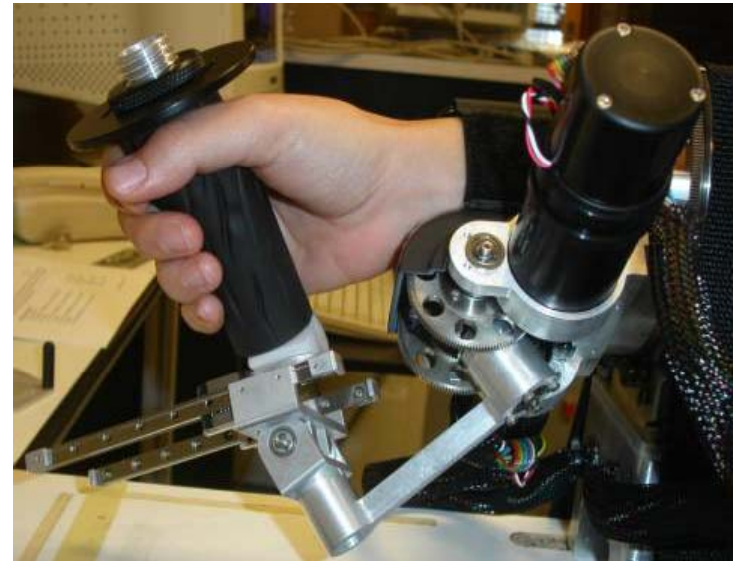


# Scientific research methods in rehabilitation

- Goal:
  - To get basic terms and scientific-research methods in rehabilitation for the goal of deepening knowledge and recognition of different effects of individual methods
- What will students gain:
  - Gain knowledge about implementation of research and writing scientific papers

# Robotics for rehabilitation

- Goal:
  - Introduction to robots for rehabilitation:
    - for students with prior knowledge of the techniques and detailed knowledge of the hardware and software of prostheses and assistive robots
    - for students with previous knowledge of medicine and the detailed knowledge of the possibilities and limitations in the application of robotic systems
  - Creating conditions for optimization of application of New technologies in rehabilitation
- What will students gain:
  - Knowledge of application of robots in rehabilitation





# Biostatistics

- Goal:
  - To learn statistical terminology and standard techniques for acquisition, grouping, describing, analyze and interpretation of data as well as understand the way of statistical thinking, especially its role and limitations in scientific work and praxis
- What will students gain:
  - Gain knowledge for practical implementation of statistics, which will be additional value in the decision process of the way of rehabilitation in specific cases

# Microcomputers

- Goal:
  - Introduction to basic architecture and components of microcomputers
  - Gaining knowledge about microcomputer peripherals and basic components of acquisition systems
  - Introduction to basic types of computer communications
  - Introduction to characteristic types of medical microcomputer devices
  - Gaining basic knowledge of digital signal processing. Introduction to operating systems
- What will students gain:
  - Knowledge of microcomputer architecture and components, computer communications and digital signal processing





Thank You for Your attention!