

Politecnico di Milano
Department of Mechanical Engineering
Applied Mechanics Group

Proposed MSc thesis topics

(for more information please contact the underlined professor)

BIOMECHANICS (also see MECHATRONICS and ROBOTICS)

1. Characterization and evolution of an artificial upper limb for subjects amputated at shoulder level (Prof. Casolo)

numerical-experimental thesis

A prototype of a new upper limb for amputees have been designed and built in our Department including all the driving boards. The mechanical structure will be improved and adapted to specific subjects. The system will be tested both in laboratory and with patients, whose learning curves will be built. A challenging part of the work is the choice and refinement of the command technique and strategy suitable for each subject.

2. Improvement and characterization of a robotic device to be mounted on wheelchairs for the functional recovery of very weak or instable upper limbs (Prof. Casolo)

numerical-experimental thesis

A new robotic home device to be mounted on a wheelchair have been recently designed and built at the Mechà.Dept including the driving board of the motors. The actual devices is still under development: at this stage the performances and the mechanic limits of the devices must be measured with patients in order to identify for which pathologies it may be profitable. The second step will concern the mechanical evolution of the system to expand the field of application.

3. Biomechanical analysis of knee joint ligaments surgical reconstruction (Prof. Casolo)

numerical-experimental thesis

The performance of reconstructed ligaments of the knee and their connection to the bones will be tested

4. Development and testing of a gymnastic machine for under water physical therapy (Prof. Casolo)

numerical-experimental thesis

Many pathologies must be treated with exercises into the water to prevent the overstress of the skeletal system. The idea is to increase the benefit of these exercises by mean of new machines specifically designed for this purpose. Mathematical models of the system must take into account of the water, the machine and the human body. An industrial partner will be involved in the research.

5. Development of control strategies for motor driven prosthetic upper limb for amputees (Prof. Casolo)

numerical-experimental thesis

The main design problem of a full prosthetic active upper limb is the choice of the command and control system to move it. It must not stress the subject, must be easy to use, safe, robust and rather fast. Some preliminary simple methods have been already developed (using head motion) but many other can be identified, implemented and tested on patients.

**6. Motion control design for an active assistive device for the upper limb (Prof. Casolo)
numerical-experimental thesis**

A new robotic **home device** to be mounted on a wheelchair have been recently designed and built at the Mech.Dept. including the driving board of the motors. The assistive device will work in several modes, rehabilitative as for physiotherapy and assistive to cooperate with the natural arm of the subjects. Theme of the thesis is evolution and test of new command and control systems. One of the most challenging part of the work concerns the decoding of the subjects will of motion.

**7.. A hydrostatic transmission for exo-skeleton drive (Prof.Cusimano)
experimental-numerical thesis**

The thesis intends to simulate, design and experimentally analyse a hydrostatic transmission for exoskeleton drive.