



This speciality considers health technologies from the system point of view, and based on multi-scales and multi-physical problems resolution approaches. The future health devices will link miniature electronic components with mechanical elements of the micro-, or even nano-scale, and with biological elements. This multidisciplinary, multi-scale, and multi-physical approach, at odds with the health technological tools of today, is the core of this specialization course.

The Major in Interacting Complex Systems is an integral part of the Labex "System of Systems Control" education program. It benefits from the Government label as a "laboratory of excellence" (Spring 2011), with 3 joint UTC/CNRS research units: BMBI (UMR 7338), Heudiasyc (UMR 7253) and Roberval (UMR 7337).

PEDAGOGICAL CONTEXT

The program relies on the strong research and education tradition in biomechanics and biomedical engineering of UTC. The classical disciplinary approaches (engineering sciences, health sciences, human sciences) will be transcended for grouping all their components into a multi-disciplinary education program.

The specialty has the following main subjects of study :

- living systems modelling,
- micro/nano-biosystems,
- weakly structured data processing and knowledge extraction,
- physical reality and complexity management,
- fluid mechanics and turbulence,
- multi-scale and multi-physical analysis and inverse problems,
- biomechanics, biomaterials and human tissue engineering.

Occupation

Expert research scientist
Research, development,
innovation project
manager
Research engineer
Adviser for public or
private institutions
and more ...






PROFESSIONAL GOALS

- Students who successfully complete the BMI Master's degree can apply for professional positions in the following areas:
- biomedical and bioengineering industries (sports and medical equipment, prosthesis, ...)
 - legal medical entities, medical devices/processes certification
 - research, teaching, higher education

Keywords

Nanotechnologies
Nano-biomechanics
Human tissue and
fluid properties
Tissue engineering
Biocompatibility
factors and cell-
material interactions

TRAINING COURSE BMI

Teaching units (30 credits/semester)	Credits
Semester 1 	
Experimental data analysis	6
Stochastic modelling	3
Scientific computing tools	3
Command synthesis methodologies	3
Dependable functioning systems	3
Cell physiology and metabolism	6
Introduction to solids et fluids mechanics	6
Digital analysis	6
Mathematics engineering techniques	6
Management, economics, entrepreneurship	4
Foreign language	4
Semester 2 	
Introduction to systems engineering	6
Experimental design, instrumentation, processing	6
Energy and flow transduction in systems	5
Algorithmic and data structure	6
Integrated systems physiology	6
Bioinformatics modelling	6
Introduction to mechanical properties and material engineering	6
Management, economics, entrepreneurship	4
Foreign language	4
Semester 3 • 1st quarter 	
Advanced Data Analysis	3
Dependable system design	3
Modelling and propagation of uncertainties	3
Optimisation	3
Smart materials	3
Method and Modeling of 3DMotion Capture	3
Mechanical Properties of Biological Systems	3
Foreign language	4
Semester 3 • 2nd quarter 	
Engineering of biologic and bioartificial systems	3
Microfluidic biological systems	3
Modelling of the neuromuscular and musculoskeletal systems in interaction	3
Modelling osteoarticular and musculoskeletal systems in interaction	3
Nanotechnologies and Nanomechanics of Complex Biological Systems	3
Multiphysics modelling of the vascular system	3
Foreign language	4
Semester 4 	
End of master studies internship	30

Practical information

Students with a background training (Bac+3) in basic and engineering sciences, life sciences, sciences and technologies, ...

Admission

First year: M1

Admission in the first year after examination file of students who own a License degree or a diploma equivalent to three years of undergraduate studies.

Second year: M2

Direct admission in the second year after examination file of students who own a Bachelor degree or a diploma equivalent to four years of undergraduate studies.

Application

File to complete and to download from the master web site, from mid-April, and to be sent by mid-June (refer to precise dates on the web site) :

www.utc.fr/master

