Dr. James SHIPPEN (Coventry University, UK)

Musculoskeletal Modelling

Information about lectures and exercises

20 hours course on "Musculoskeletal Modelling", a short course of Computational Biomechanics
Target auditorium – I, II and III study cycle students from biomechanics, biomedical engineering, mechanical engineering.
Lectures – fundamental concepts and theory of computational biomechanics applied to modelling of human musculoskeletal system.
Exercise – application by the student of the information imparted within the lectures.

Schedule of the lectures

Day	Topic	Type	Hours	Date and time	Room
Basic knowledge					
1	Introductory lecture to musculoskeletal modelling	Lecture	3	2017.12.04 16^{20}-17^{55}	MR-II 2-106
	Introduction to the BoB musculoskeletal modelling package	Lecture	1	2017.12.04 18^{10}-19^{45}	MR-II 2-106
2	Installation and application of BoB to basic exercises	Exercise	4	2017.12.05 16^{20}-17^{55}	MR-II 2-107
				2017.12.05 18^{10}-19^{45}	MR-II 2-107
3	Introduction to advanced exercise	Exercise	4	2017.12.06 16^{20}-17^{55}	MR-II 2-106
				2017.12.06 18^{10}-19^{45}	MR-II 2-106
4	Completion of advanced exercise	Exercise	4	2017.12.07 16^{20}-17^{55}	MR-II 2-107
				2017.12.07 18^{10}-19^{45}	MR-II 2-107
5	Student presentations and feedback	Seminar	3	2017.12.08 16^{00}-18^{15}	MR-II 2-107
	Summary and discussion		1	2017.12.08 18^{15}-19^{00}	MR-II 2-107

Dr James Shippen is a Principal Lecturer in the Centre for Mobility and Transport Research at Coventry University UK. His first degree is in Mechanical Engineering from the University of Leeds, UK and his PhD is from the University of Birmingham, UK in Mechanical Engineering on the subject of coupled acoustic-structural finite element analysis. At the University of Birmingham he was the Director of Biomedical Engineering, followed by a period as the technical director of a biomechanical analysis commercial organisation. At Coventry University he has initiated three Masters Courses and written the BoB musculoskeletal package.

Computational biomechanics
Mechanical engineering students will be familiar with using the theories of Newton, Lagrange and Laplace to calculate the motion of engineering components and systems however, these techniques are equally applicable to the mechanism of the human body. This course will apply conventional engineering analysis to a complex mechanical linkage, which happens to be a person. This approach will enable the student to look inside the body to establish the load in the skeleton, joints and muscles generated during a range of everyday tasks from standing still through gait to sporting activities and beyond.

The course will be a combination of theoretical information conveyed in a series of lectures, practical experiments performed by the students under the supervision of the lecturer and presentations by the students to the lecturers from which the student will receive feedback.

Throughout the course, the students will use the Biomechanics of Bodies (BoB) software, which can undertake kinematic, kinetic inverse dynamic analysis of human motion. They will also capture their own motion using a magneto-inertial system and analyse the movement in BoB to calculate biomechanical variables associated with their motion, for example, joint contact forces, joint torque, muscle lengths, ground reaction forces.

The learning outcomes of the course will be for the students to appreciate and be able to apply the capabilities of computational biomechanics to calculate biomechanical characteristics of human motion. They will also be able to measure human motion and use this data as an input for a biomechanical analysis.