



INVESTMENTS IN EDUCATION DEVELOPMENT

Biomechanics at the University of West Bohemia

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The talk presents biomechanical activities at the University of West Bohemia. It concerns human body modelling (full body and segment models) for industry and medicine, joint replacement modelling, modelling of heterogeneous materials and complex structures, biological fluids (flow in aneurysm) and experimental background.

Biomechanics at Brno University of Technology

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Biomechanics at the Institute of Solid Mechanics, Mechatronics and Biomechanics has a long tradition having started in 1980's with stress-strain analyses of some clinical problems concerning musculo-skeletal system. Later the range of investigation was enlarged to other problems with the following main achievements:

- Mechanical testing of various types of tissues, animal as well as human, and identification of their constitutive models.
- Musculo-skeletal system analyses of healthy and pathologic (hip, elbow) joints, with and without endoprostheses, simulations of various types of bone and spine fixators.
- Cardio-vascular system
 - Rupture prediction of abdominal aortic aneurysms, taking into consideration not only the undeformed geometry, but also residual stresses and intraluminal thrombus,
 - Determination of directions of collagen fibers in tissues using Fast Fourier Transformation.
- Hearing organ: computational simulations of function of human ear including ear drum.
- Vocal chords: proposal of artificial vocal chords supported by computational simulation of their function.

The division of biomechanics

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The Division of Biomechanics (<http://www.biomechanics.cz>) has a long history of research in biomechanics and innovation in orthopaedics going back to the pioneering work of Jaroslav Valenta in the 1970s. Research is performed in cutting-edge laboratories specializing in multi-level experimental and computational approaches. The Division of Biomechanics is involved



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in a variety of multidisciplinary projects with partners ranging from orthopaedic device producers through health professionals to automotive industry. The main topics of basic and applied research involve using engineering techniques to solve orthopaedic problems and develop new orthopaedic devices, understanding mechanical properties of tissues of cardiovascular system and application of advanced experimental methods in cell mechanics. Division of Biomechanics provides education in master study program Biomechanics and medical devices and Ph.D. study program Biomechanics.

**Biomechanics research in Faculty of Physical Culture Palacký University Olomouc
and Human Motion Diagnostic Center University of Ostrava**

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The biomechanical research activities of both departments deal with biomechanics of basic human motions in various groups of subjects, biomechanics of sport and physical activity. The most often used methods are: 3D kinematics (Vicon MX, Qualysis), ground reaction force measurement (Kistler), pressure distribution analysis (Footscan), electromyography (Delsys). Recently Olomouc group solve projects mainly in following topics: assessment of static and dynamic balance in various groups (young, middle age and older groups; subjects with amputations), the effect of rehabilitation on gait and balance in ballet dancers, the effect of treatment (surgery, orthotic, rehabilitation intervention) on gait in orthopaedic patients (knee, hip osteoarthritis). Ostrava group nowadays solve, for example issues as the biomechanics of pathological running in people after Achilles tendon surgery, biomechanical risk factors for knee injury in volleyball, biomechanics of walking in people with a bionic knee after transfemoral amputation, the kinematics of vaults in gymnastics or load optimization in strength exercise.

**Hemi-epiphysiodesis at the knee region: long - term results of Ambulant Centre for
Defects of Locomotor Apparatus in Prague**

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The Ambulant Centre for Defects of Locomotor Apparatus in Prague has achieved very good results with permanent epiphysiodesis that was carried out both in cases of unequal leg length and at deformities around the knee joint. The goal of the communication is to present our last ten years of experience with anthropometric measurement of tibio-femoral angle, indication and timing of the surgery and long-term results of permanent hemi-epiphysiodesis (carried out by modified Macnicol's method using drilling of growth physis) that was indicated to children