

Image-Based Measurement and Biomechanical Analysis of the Knee Joint During Functional Activities



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Abstract

Knowledge of the kinematic and force interactions between the force-bearing structures of the knee joint, including articular surfaces, ligaments and muscles, during multi-joint functional activities is helpful for a better understanding of the normal function of the joint and the mechanisms of injuries and diseases, as well as for the planning and evaluation of subsequent treatment. Skin marker-based stereophotogrammetry has been widely used in measuring inter-segmental motions of human movement. However, the detailed kinematics of the articular surfaces and the surrounding tissues cannot be measured simultaneously. Study of the internal force interactions within the knee *in vivo* thus remains a great challenge. To bridge the gap, an approach based on the integration of medical image-based techniques and finite element modeling methods has been developed. In this presentation, a brief description of these developments will be given. In particular, the development of a digitally reconstructed radiograph (DRR) based 3D fluoroscopy method and its application to the study of the knee joint during various activities including cycling will be presented. The new integrated approach provides a more comprehensive subject-specific biomechanical analysis of the knee during weight-bearing functional activities. Considering the radiation dosage involved in the fluoroscopy-based methods, the development of a new slice-to-volume registration method using FLASH MRI for the real-time measurement of the 3D kinematics of the knee *in vivo* will also be described.

Professor Tung-Wu Lu 's bio

Professor Tung-Wu Lu received his D.Phil. degree in Orthopaedic Engineering from the University of Oxford, UK, in 1997. After one year working as Junior Research Fellow at St. Peter's College, Oxford University, and another year as Assistant Professor at School of Physical Therapy, China Medical University, he joined National Taiwan University (NTU) in 1999, where he is now Professor of Biomechanical Engineering at Institute of Biomedical Engineering, and Joint Professor at Department of Orthopaedic Surgery

and School of Occupational Therapy. He was Director of NTU Rehabilitation Engineering Research Center from 2007-2011, and is currently Head of Assistive Technology Division of the NTU's Health Science and Wellness Center. He is also President of the 3D Analysis of Human Movement Group of the International Society of Biomechanics. His research interests include human motion analysis, orthopaedic engineering, imaging biomechanics, sports medicine and biomechanics, mathematical modeling of the neuromusculoskeletal system, wearable sensing technology, and rehabilitation engineering. He has published over 145 peer-reviewed journal papers and over 300 conference papers, and is Editor-in-Chief of Biomedical Engineering: Applications,

More information here:

http://bme.ntu.edu.tw/english/introduction/faculty/faculty_TungWuLu.php