How multilevel biomechanical modeling can help in understanding sport movement and designing sport equipments.

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Abstract

Analysing the complete influence of a sport equipment is highly difficult due to its multifactorial nature (covering physiology, biomechanics, motor control, and psychology). Indeed, changing the sport equipment can deeply modify the performance, in terms of absolute timing (lower running or cycling speed for example), by changing the way the musculoskeletal system is solicited or by favouring related-injuries. In this presentation, two points will be addressed. First, musculoskeletal modelling (EMG-Driven model) will be used to understand how wearing a running shoe can affect the muscle and tendon behaviours during the activity. Second, a finite elements model of the shod foot driven by experimentally-estimated muscle forces will be presented. This model can be used to numerically simulate modifications of the running shoe characteristics and assess their influences over the strain and stress of the different structures of the foot. These points will cover both fundamental and applied aspects in sport sciences.

Dr. Guillaume Rao's bio

Guillaume earned a M.Sc. in Engineering and Ergonomics of Human Movement (Aix-Marseille University) and a Ph.D. in Human Movement Sciences (Aix-Marseille University), He is currently associate professor in Biomechanics both at the Sport Sciences Department of Aix-Marseille University and at the Institute of Movement Sciences (UMR CNRS 7287) in Marseille, France. He is currently involved in the development of the TechnoSport research center in Marseille, dedicated at gathering sport scientists, medical doctors, sport brands and sport players around a single place

to foster innovation in sport gear. His work focuses on understanding the lower limb and foot functions in animals and human beings. He regularly use motion capture, biomechanical modeling and nonlinear analysis techniques to assess descriptive variables of the locomotion such as local dynamic stability, joint kinematics, muscle activations and forces, muscle fibre behavior, and joint and ligament strain. Based on these analyses, he is looking for answers to fundamental questions about the functioning of the human body in order to develop sport equipment and clinical methodological routines.

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