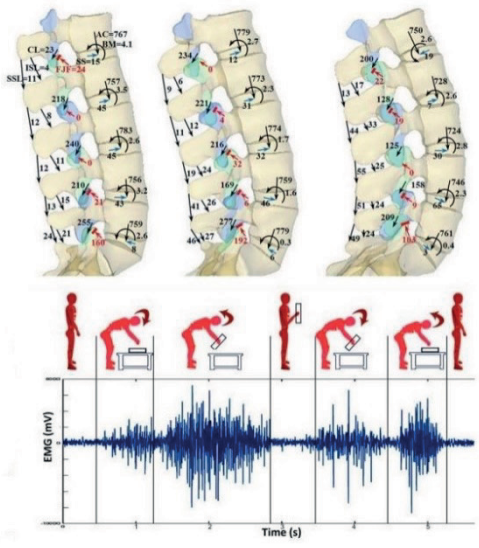
Abstract



Many of the treatments to different injured musculoskeletal components do not fully restore their function to a pre-injury state. Many of the proposed hip, knee, shoulder and spinal implants are accompanied by a loss of the normal active behavior. Dr. El-Rich's main research is focused towards understanding the mechanical behavior of different healthy versus symptomatic musculoskeletal components with a long term goal of restoring normal active behavior to injured or symptomatic individuals.

The mechanical behavior of the human musculoskeletal system can be investigated experimentally or with mathematical models. Given the complexity of such system, approximate solutions of the mathematical relationships describing its behavior, can be obtained by computational models such as the Finite Element (FE) models. FE modeling has been extensively used for the determination of the mechanical stresses and strains that are induced by physiological activities, pathological and injury conditions, or surgical modifications. The knowledge of bone stresses in in-vivo conditions for example, which cannot be measured noninvasively, is in fact of great importance in research, prosthesis design and clinical practice. On the other hand, in-vitro experiments are time consuming and expensive. Numerical models, when compared with most experimental techniques, estimate stress/strain field over the whole region of interest rather than in a few selected points, and permit a time-effective and virtually infinite variation of study parameters. Moreover, image processing and FE model generation procedures developed in the last 20 years facilitate patient-specific FE models to be derived from in-vivo diagnostic data.

Dr. El-Rich's current research includes but not limited to computational biomechanics of the human spine. One of his projects aims at studying effects of inter-subject spinal curvature and trunk mass distribution variation on the mechanical response of the spine which may help understand why some people experience low back pain (LBP) while others with similar weight and height do not, even under similar activities. Also, with close collaboration with industry, Dr. El-Rich is investigating job physical demand that can be match with workers taking into account their capability and limitations. To avoid work-related injuries, industries should take proactive measures to ensure that workers and workstations, particularly those involving heavy physical work, adhere to proper ergonomics practices, measures, and standards. In particular, this research aims to prevent or reduce muscle fatigue and excessive joint forces and moment that may lead to injury by assessing and quantifying the associations between workstation factors and body response.

Speaker's Bio

Dr. Marwan El-Rich is an Associate Professor at Khalifa University's Department of Mechanical Engineering. He worked at the University of Alberta in the Department of Civil and Environmental Engineering from 2010 to 2016. He was also an adjunct professor in the Department of Biomedical Engineering at the same university. Dr. El-Rich worked as an engineer expert in Biomechanics for two years at Altair Engineering France after completing two years of postdoctoral fellowship at the Laboratory of Impact Biomechanics (LBA-INRETS) in Marseille (France). Dr. El-Rich was awarded a PDF scholarship from the Government of Quebec (Canada). He is a professional engineer (PEng) and member of the Association of Professional Engineers and Geoscientists of Alberta (APEGA), the European Society of Biomechanics, and the American Society for Engineering Education (ASEE).

Dr. El-Rich's main research is Computational Biomechanics of the Human Musculoskeletal System with a particular interest in Human Spine Modeling. He worked on a variety of projects including but not limited to the determination of load-sharing in the lumbar and cervical spine under various loading conditions using Finite Element and Musculoskeletal models, development of a generic prosthetic talus, physical demands analysis of manufacturing operations, etc. Dr. Marwan is working on a variety of projects in collaboration with Cleveland Clinic Abu Dhabi and Abu Dhabi Police. The aim of Dr. El-Rich's research is to attract the clinical and industrial communities to establish collaborations and provide partial or full financial and in-kind support to train both undergraduate and graduate students in a unique learning environment supported by multidisciplinary collaboration that would benefit and unite students from various backgrounds, including biomedical and mechanical engineering, computer science, and medicine.