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Evaluation of different knee joint kinematic models

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In this paper, we focus on estimation of knee joint kinematics in sagittal plane. Assuming that the femur is a fixed segment during movement, the proper characteristic points are assigned on tibia. The proposed model, namely the ellipse normal method (ENM), approximates the trajectories of each point by the ellipse curves. Therefore, the model could be easily incorporated in the design stage of rehabilitation manipulator. The passive flexion movement for a seven year old subject, undergoing the distraction osteogenesis, is recorded via single plane fluoroscopy. Specific bone landmarks and shapes corresponding to tibial condyles and shaft are assigned on the images and are used as initial data. The real movement of tibia towards femur is compared with three different approximation models. The following kinematic models are discussed: The arcs of two circles rolling on the flat plane (proposed by Iwaki et al.), ellipse rolling on another ellipse (proposed by Lee et al.), and ENM. The mechanical axes positions in the function of the flexion angle are evaluated for each presented model. The ENM proves to be the most reliable in terms of approximation of real knee movement..

Biography

Marta Drazkowska has completed her Master's degree from Poznan University of Technology, Faculty of Computing. She did her PhD studies in the field of Rehabilitation Robotics. She has participated in the project aiming to construct the knee joint rehabilitation manipulator for patients with Ilizarov apparatus. Her main tasks included adaptive control of 1DOF flexible manipulator enabling execution of basic rehabilitation trainings, as well as the construction of passive element altering the rotation axis in knee joint.

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