KNEE JOINT KINEMATICS AND ITS APPLICATIONS IN PROSTHETIC LIMBS DESIGN

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ABSTRACT

Walking is humans natural means to move from one place to another. Walking or gait cycle involves the motion of many of the body limbs and joints. Knee plays such an important role in the gait cycle. Motion of knee joint is not that simple kind of motion, it involves planer rolling and gliding motion as well as out of plan motion.

Artificial limbs are used to enable amputees to function normally. Above knee artificial leg has not been so successful in the past. Knee unit is a very critical component of the above knee prosthetic limb. Polycentric prosthetic knee units are used to simulate the kinematics of normal knee joint, which is important for amputee to develop a normal gait. Designers came out with several polycentric knee unit designers.

In this study, kinematics of the knee joint motion was employed to determine the most appropriate polycentric knee unit design. Kinematic analysis was performed on three polycentric knee system. The obtained femur profile and rolling to gliding ratio through flexion for .the three systems, where compared to the desired femur profile and rolling to gliding ratio. Two of these systems were found kinematically inappropriate passed on the rolling to gliding ratio. The crossed four-bar linkage prosthetic knee system was found to be the best in simulating the knee joint kinematics.

Dynamic analysis were done for the crossed for-bar knee system to determine the maximum load the links would carry during the worst case of loading (running).

In order to make the prosthetic knee suitable for each single case by itself, a set of dimensions for the crossed four-bar knee unit where introduced. These dimensions were determined based on the actual size of the knee bones. Some parameter where used to define the bones size. The knee unit dimensions where defined in terms of the knee parameters. This dimension is to be used for the initial setting of the prosthetic knee unit.