

Human Joint Simulation Using LifeMOD Co-Simulation

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Advanced design of human artificial joints requires an in-depth understanding of the dynamic interaction between the very stiff bone replacement material and the softer viscoelastic cartilage replacement material. It must take into account both the large displacement gross motions as well as the small displacement elastic responses. A co-simulation methodology has been developed in

BRG LifeMOD, connecting Adams/Solver, a large displacement multi-body dynamics code, to Marc, a nonlinear finite element code. This efficient co-simulation approach allows for each code to handle that portion of the system for which it is most capable, while adding the potential to work across multiple CPUs and operating systems as desired. The method was applied using LifeMOD/KneeSIM to simulate an artificial knee joint, containing cobalt chromium steel and ultra-high molecular weight polyethylene contact elements, undergoing a normal walking gait to predict kinematics, forces and the resulting wear patterns.