

Simulation of Human Movement: Applications Using OpenSim

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Computer simulations are playing an increasingly important role in solving complex engineering problems, and have the potential to revolutionize experimentally-based medical decision making and treatment design. Experiments alone provide important but limited understanding of movement dynamics. Although we can measure some quantities, such as muscle activities and ground reaction forces, responsible for a movement, simulations complement these measurements with estimates of other important variables, such as muscle and joint forces. Simulations also allow us to establish cause-and-effect relationships giving insights into muscle function. Perhaps the most exciting feature of simulations is the potential to perform “what if” studies to test hypotheses, predict functional outcomes, and identify emergent behaviors. This presentation will highlight our latest work using OpenSim, including projects which: minimize measures of an unreasonable simulation; establish relationships among posture, stability, muscle forces, and ground reaction forces; and identify new movements as an athletic training tool to reduce injury risk.