Simulation of shoulder and elbow joints movement under different trajectory conditions

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Extended abstract

There is a growing need for the use of computational biomechanics and simulation in the life sciences. Understanding the kinematics of the human locomotor system plays an important role in medicine, kinesiology, humanoid robotics, etc. As a result, many models have been written and many simulations of human movement have already been carried out. But nevertheless, a lot of research is still to be done on cases, where movement is affected by different pathologies.

In this article, a kinematic model of human upper arm will be presented and simulated. The model will cover two joints: a spherical joint in the shoulder and a hinge in the elbow. Rotations of the joints will be given in terms of rotational matrices. The model will be used in a series of different simulations of movement with given starting and ending point. To avoid natural redundancy, there will be some coditions set for the resulting trajectory of the endpoint of the arm. An example of such condition is the minimization of kinetic energy of the motion.

The article will also cover some simulations of the same movement in the case of a very known pathology called calcination, or calcific tendonitis in the shoulder. The affect of the desease on the motion of the arm will be modeled by a pain coefficient*, that is a function of angles of the shoulder joint rotations and time (in the case of recovery).*

In all of the above-mentioned simulations, different order aproximations will be used (and compared) for the angles of rotations.

References

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