Abstract

Optimal human forearm trajectories structure was investigated using Optimal Regulator. First, the continuous dynamics of the human forearm were established on the basis of the relation between muscle torque and neural control signal and employed Riccati differential equation to obtain the optimal movement trajectory of the human forearm. The model and control of a human forearm is analyzed. In the advanced control of robotic manipulators, it is important for manipulators to track trajectories in a wide range of work place. If speed and accuracy is required, the control using conventional methods is difficult to realize because of the high nonlinearity of the robot system. In this work; we study the problem of human hand control carrying a mass. The equation of motion and the natural frequency of the forearm for small angular displacement are derived. We develop new methods that use vector fields in the controller construction for a set of nonlinear dynamical systems. The paper deals with compensate of non-linear system which has a similar idea as the method mentioned in linear system. We utilize an optimal regulator and suggest human arm activities under dynamic environments. Humans must pay compensation for loads arising from interaction with the physical environment. We have managed to design a control law for the non-linear arm-mass-system, in such a way that the representation of a closed loop system is affine, controllable, and a closed loop system is asymptotically stable. Throughout any motion, the forearm can be considered a one-link robot manipulator which could be exploited to benefit people with disabilities (missing extremities). An optimal controller calculates the motor
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command, which minimize the cost function for nonlinear arm dynamics. Therefore, the purpose of our study is to construct a computational model of arm movement. For this purpose, we use an optimal regulator as the model and compare simulated arm movements with actual nonlinear model human movements. In this paper, we present two approaches to human arm modeling: finite time optimal regulator control approach and modern nonlinear control approach. The latter one is formalized using Lie-Derivative based controllers.

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