H-infinity Based Full State Feedback Controller Design for Human Swing Leg

Abstract - In this paper, the robustness properties of H-infinity control to produce a dynamic output feedback controller is applied to a human swing leg system. The double pendulum structure is usually used to model this system. The pendulum links will represent the thigh and shank of a human leg. The upper body will be connected to the thigh and then the shank via hip and knee joints. The muscles of thigh and shank are moved by applied two external (servomotor) torques at the hip and knee joints. The mathematical model of the system is developed. The results show that the proposed controller can robustly stabilize the system and achieve a desirable time response specification. The results are obtained by using Matlab program and the achieved time response specifications are rise time $t_r=0.18$ seconds, settling time $t_s=0.25$ seconds and maximum over shoot $M_p=0.03$ for hip joint and $t_r=0.13$ seconds, $t_s=0.21$ seconds and $M_p=0.01$ for knee joint.

Keywords - Human Swing Leg, robust controller, H-infinity control, state feedback controller.