DEVELOPMENT OF ADVANCED CONTROL SYSTEMS FOR COMPARISON STABILITY STUDY OF A ROBOTIC LEG APPLICATION

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ABSTRACT

The perspective presented here is that stable and unstable system depends on an effect of a torque which is proportional to speed and opposed to motion and force applied to the plant. It shall be argued in this paper that inverted pendulum is one of the unstable systems. Therefore, the inverted pendulum is essential in the evaluating and comparing of various control theories. This project is about a study of two or more advanced control systems for comparison stability control of a robotic leg application by using real-time MATLAB software as well as developing the rotating disk mechanism, based on Furuta Pendulum concept. Furthermore, this self-balance development mechanism will be using the advanced controller as its brain to measure and self-stabilize its own movement on the disk. Three main systems that will be the focus, namely: a robotic leg modeling, an advanced control systems using real-time MATLAB software and mechanical structure of rotating disk with pendulum mechanism (Robotic Leg). The importance in stabilization of the Furuta Pendulum, the system should be properly set up, which include the plant, electronic components, mechanical hardware and controller. The rotational inverted pendulum is recognized by mounting the pendulum on motor shaft and by controlling the motor. This is to ensure that the pendulum maintained in vertical position with restricted angle oscillation. The main purpose of this project is to develop and analyze dynamical modeling of the robot leg that consists of an inverted pendulum on rotating disc with one or more advanced control techniques by using real-time MATLAB. DC servomotor, others electronic components and mechanical part will be

implemented to build an inverted pendulum plant. Motor and optical quadrature encoders would not operate without H-bridge driver as a power switching that detected and measured the position, speed and movement of DC motor and pendulum. The Hall Effect current transducer is used as a feedback sensor which measures the current of the motor. As the Plant of a Single Robotic Leg Application is developed, the motor and robot driver (power driver – H –Bridge) will be integrated with the MATLAB software and Plant for development of control algorithm. Overall, a method on how to implement one or more advanced control systems into this embedded control application is briefs. Practical results of experimental data will be deduced in bode and Nyquist graph from MATLAB root locus as a perspicuous view of its stability.

(Keywords: advanced control, pendulum, real-time MATLAB, stability)

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