

**Fuzzy Control of a Rotary Inverted Pendulum using LabVIEW**

By

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## ABSTRACT

In this thesis a fuzzy controller was designed using National Instruments LabVIEW 8.2 software package and its Fuzzy Control Toolbox to balance a rotary inverted pendulum. The pendulum is a popular test-bed used for controls research and practical applications such as satellite positioning and aircraft maneuverability. The fuzzy controller was designed by mapping the LQR control law into two parallel fuzzy inference systems. By mapping into two fuzzy controllers, instead of just one, the total number of fuzzy rules was reduced to fifty. Reducing the number of rules decreased valuable computation and execution time needed to perform real time control. The LQR gains were mapped through the fuzzy input and output gains and the summation operation was performed through the fuzzy rules. The real time data was collected using National Instruments Data Acquisition card NI-6221. The fuzzy controller and LQR were shown to have similar simulation and experimental results while stabilizing the system within six seconds. A step by step tutorial is included in the Appendix to illustrate the fuzzy control design

*Key words:* Fuzzy control, rotary inverted pendulum, LabVIEW, LQR, tutorial, NI-6221.