

Kittipong Yaovaja 2008: Optimal Control of a Two-wheeled Robot with High Bandwidth Tilt Measurement. Master of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Mr. Withit Chatlatanagulchai, Ph.D. 111 pages.

A two-wheeled robot is independently driven by two concentric motors. The two-wheeled robot is a marginally stable plant. Control of the robot for stabilizing and obtaining some desired responses are complicated because the plant is nonlinear, non-minimum phase and its inputs are lower than its outputs.

In this research, the LQR control and LQR control with integrator augment, including state observer in order to estimate states, of a two-wheeled robot are shown in theoretical, designed and simulated with MATLAB and implemented. Luenberger observer is also presented in order to improve tilt measurement from an inclinometer and a rate gyroscope.

Both simulation and experiment of estimated tilt measurement are accurate over a high frequency range. Pole placement with a variety of pole position result as accuracy over a variety of frequency range. Simulation and experimental results demonstrate the reliability and effectiveness of the proposed control scheme even if oscillation occurs in experiment due to frictions and oscillated wire weight. Position control shows slow response because of coupling of pose control, but making a turn has high accuracy.

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Thesis Advisor's signature

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