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| **Title:** | Balancing of an Inverted Pendulum using PD Controller | | |
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| **Abstract:** |  |
| Balancing of an inverted pendulum robot by moving a cart along a horizontal track is a classical problem in the field of Control Theory and Engineering, for the beginners to understand its dynamics. Several physical models can also be simplified as elastic inverted pendulums like rockets and walking robots. Many researchers have been applying different control algorithm and design techniques such as PID Controller, State Space, Neural Network, Genetic Algorithm (GA) even Particle Swam Optimization (PSO), in both digital and analog domain using various sensors. However, this can also be done by using a single potentiometer as a sensor and Proportional Derivative Controller (PD) controller as the design algorithm. The comparison or difference between the reference and the potentiometer generates control signal to drive the system. In this case, it consists of a thin vertical rod attached at the bottom, referred to as pivot point mounted on a mobile toy car. The car, depending upon the direction of the deflection of the pendulum moves horizontally in order to bring the pendulum to absolute rest. The main idea behind this control process is the use of PD (Proportional and Derivative) controller to generate signal to control the speed and direction of the motor. The only sensor used in this project was a potentiometer (pot) which was attached with the pendulum rod. The variation in its resistance causes change in voltage and afterward, it was compared with the reference voltage to generate the appropriate control signal. PROTEUS software was used for circuit simulation, frequency responses of the system were analyzed in MATLAB with different values of KP and KD. Finally, to represent the system stability, root locus diagram was drawn using MATLAB. | |