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| **Title:** | PD controller for balancing an inverted pendulumn cart. | | |
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| **Abstract:** |  |
| In the arena of Control theory and Engineering, balancing of an inverted pendulum by moving a carrier (cart) along a horizontal track, is a classical problem for the commencers to analyze its dynamics as it continually moves toward an unstable state. Numerous physical models resembling to the same include Flight Simulation of rocket or missile during the initial stages of flight, Simulation of dynamics of a robotic arm, Model of a human standing still etc. Many researches concentrating on this field have been using different control algorithms and design techniques from PID controller, state space, neural network, genetic algorithm (GA) to particle swam optimization (PSO), in both digital and analog domain using various sensors. However, this can also be performed using a single potentiometer as a sensor and PD controller as the design algorithm. The difference between the reference (zero voltage) and potentiometer (voltage difference due to change in resistance) generates control signal to drive the system. Here, in this work, it consists of a thin vertical rod attached at the bottom (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 was 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. It was attached to the pendulum rod and the variation in its resistance caused change in voltage across it which was compared with the reference voltage (zero) to generate the appropriate control signal. PROTIUS software was used for circuit simulation, frequency responses of the system were analyzed in MATLAB with different values of gains, KP and KD, and finally the Root Locus diagram showing the system stability was drawn in MATLAB. | |