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Abstract
The inverted pendulum system is an unstable and nonlinear system. It is a common teaching and experimental platform in the control field. Because the mechanism of this system is not complicate, this system provides a platform for verifying the effectiveness of different control schemes.
In this paper, the dynamic equations of the rotary inverted pendulum is derived by the Euler-Lagrange formulation, and the DC motor model is built for driving the inverted pendulum. The control objective is to swing up the pendulum from the downward position to the upright position and balance it there, then drive it to rotate back and forth and maintain its balance in the meantime. The swing up controller adopts the energy-based control scheme, and the linear quadratic regulator is used to achieve balancing control. Then PD controller is employed for trajectory tracking control. MATLAB/Simulink is used to simulate each process. Also, the control law is implemented using TMS320F2812 digital signal processor in the experiment. The D/A converter is used to convert the digital signal to analog signal. Then a driving circuit provides the required current for the DC motor in the rotary inverted pendulum system.
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