Analysis and control of a rotation inverted pendulum using dynamic structure fuzzy systems

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ABSTRACT

Inverted pendulum systems are typical nonlinear and unstable systems. They are experimentation equipment which usually used to verify the feasibility of the control theory. This paper presents a dynamic structure fuzzy system for model reference adaptive control of nonlinear systems whose dynamic models are poorly understood. The dynamic structure fuzzy system is to reconstruct the unknown nonlinearities of the dynamic systems. In the dynamic structure system, the reference model provides closed-loop performance feedback for generating or modifying a fuzzy approximation knowledge base. The number of fuzzy rules can be either increased or decreased with time based on the required accuracy. The tracking error converges to the required precision through the adaptive control law derived by combining the dynamic structure fuzzy system and the Lyapunov synthesis approach. At last we simulate an inverted-pendulum system control demonstrate the effectiveness of our scheme.

Keywords : fuzzy control ; nonlinear uncertain system ; adaptive control

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