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A Robust Model Predictive Control for a Photovoltaic Pumping System Subject to Actuator Saturation Nonlinearity and Parameter Uncertainties: A Linear Matrix Inequality Approach

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Abstract : In this paper, a robust model predictive controller (RMPC) for uncertain nonlinear system under actuator saturation is designed to control a DC-DC buck converter in PV pumping application, where this system is subject to actuator saturation and parameter uncertainties. The considered nonlinear system contains a linear constant part perturbed by an additive state-dependent nonlinear term. Based on the saturating actuator property, an appropriate linear feedback control law is constructed and used to minimize an infinite horizon cost function within the framework of linear matrix inequalities. The proposed approach has successfully provided a solution to the optimization problem that can stabilize the nonlinear plants. Furthermore, sufficient conditions for the existence of the proposed controller guarantee the robust stability of the system in the presence of polytypic uncertainties. In addition, the simulation results have demonstrated the efficiency of the proposed control scheme.

Keywords : PV pumping system, DC-DC buck converter, robust model predictive controller, nonlinear system, actuator saturation, linear matrix inequality
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