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Comparative Analysis of the Model-free Tuning Techniques for Integral State Feedback Controller of a Liquid Slosh Suppression System

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Abstract

This paper presents a comparative study of the model-free controller tuning for a liquid slosh suppression system. Data-driven Pole Placement (DPP) and Fictitious-Reference-Iterative-Tuning with Particle Swarm Optimization (FRIT-PSO) are the two algorithms proposed as the tuning methods for the selected controller structure. These techniques are desirable to obtain the optimal parameters gain of the state feedback controller with the integral term by utilizing only the recorded input-and-output data generated from a one-shot experiment. The system's performance analysis of the controlled system is carried out using MATLAB Simulink. The assessment proves that the model-free control approaches exhibit a good response of the cart in terms of the trajectory tracking of the cart's motion while maintaining the liquid slosh motion at the minimum level.

Keyword: Integral state feedback controller; DPP; FRIT-PSO.