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Model-based Optimal Control Design for Slow Orbit Feedback at the Siam Photon Source

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A model-based optimal control approach has been developed for the slow orbit feedback (SOFB) system to enhance orbit stability in the Siam Photon Source (SPS) storage ring. The control strategy utilizes a linear quadratic regulator (LQR) based on a multi-input, multi-output (MIMO) state-space model of the linear SPS storage ring, derived through system identification using MATLAB and SIMULINK. The necessary and sufficient conditions for controllability and boundedness of the dynamic system are established. Experimental simulations were conducted to assess the performance of the LQR controller in a practical SPS storage ring. The results demonstrate that the proposed control method effectively minimizes the quadratic cost function and error signals between setpoints and process variables for both horizontal and vertical orbit positions while ensuring system stability and robustness. The study also outlines the fundamental principles of optimal control theory, system identification, and future development directions.

Footnotes

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Funding Agency

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I have read and accept the Conference Policies

Yes

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