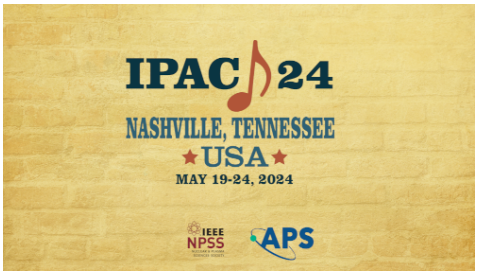

Contribution ID: **1009** Contribution code: **THPG29** Type: **Poster Presentation**

A multi-variable approach to mid-ranging control for unified operation of fast and slow correctors in fast orbit feedback system

Thursday 23 May 2024 16:00 (2 hours)

Advanced Photon Source Upgrade (APS-U) Fast Orbit Feedback (FOFB) system uses 160 fast and 160 slow corrector magnets to stabilize orbit measured at 560 Beam Position Monitors (BPM). We plan to operate both fast and slow correctors in a unified feedback algorithm at 22 kHz correction rate. Mid-ranging control is a proven approach for feedback systems with two manipulated inputs each exerting distinct dynamic effects to regulate a single output. This method resets the fast input to its chosen DC setpoint and proves beneficial when cost of fast input is more than the slower one. Unified operation of fast and slow correctors is a fitting application to mid-ranging concept which is well founded for two input one output systems. In this work, based on the cross-directional nature of the FOFB system we developed a multi-variable approach to mid-ranging control. It can be applied to FOFB with multiple fast and slow correctors, and multiple BPMs. Performance of proposed scheme is tested in simulations with APS-U FOFB prototype model in MATLAB. The feedback loop with fast and slow correctors is stable with mid-ranging algorithm, and the fast corrector drives effectively tracked setpoints.

Footnotes

Funding Agency

This research used resources of the Advanced Photon Source, operated for the U.S. Department of Energy Office of Science by Argonne National Laboratory under Contract No. DE-AC02-06CH11357.

Paper preparation format

LaTeX

Region represented

North America

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Session Classification: Thursday Poster Session

Track Classification: MC6: Beam Instrumentation, Controls, Feedback, and Operational Aspects: MC6.T05 Beam Feedback Systems