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Initial Test Results of An SRF Cavity Field and Resonance Controller Based on Dynamic Mode Decomposition

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Field and resonance control of superconducting radio frequency (SRF) cavities are often implemented as independent control loops. A control loop for amplitude and phase uses the power amplifier signal as the control signal and a separate loop for resonance control uses a piezo tuner. Traditional proportional-integral (PI) loops are implemented for field control, whereas more elaborate techniques, including active noise cancellation, are implemented for resonance control. This paper presents a novel approach that can effectively stabilize amplitude and phase by only using the piezo actuator, keeping the power amplifier output level constant. For this purpose, we have designed a model predictive controller (MPC), based on the dynamics of a cavity model developed using dynamic mode decomposition (DMD). We have implemented the proposed controller on a LCLS-II LLRF system, and here we present the initial test results and performance of the system using cold SRF cavities.

Keyword

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