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Active Cancellation of Acoustical Resonances with an FPGA FIR Filter ALBERT RYOU, JONATHAN SIMON, Univ of Chicago — We demonstrate a novel approach to enhancing the closed-loop bandwidth of a feedback-controlled mechanical system by digitally cancelling its acoustical resonances and antiresonances with an FPGA FIR filter. By performing a real-time convolution of the feedback error signal with an arbitrary filter, we can suppress arbitrarily many poles and zeros below 100 kHz, each with a linewidth as small as 10 Hz. We demonstrate the efficacy of this technique by cancelling the six largest resonances and antiresonances of a high-finesse optical resonator piezomechanical transfer function, thereby enhancing the unity gain frequency by more than an order of magnitude. More broadly, this approach is applicable to stabilization of optical resonators, external cavity diode lasers, and scanning tunneling microscopes.

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