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Active Control of Kink Modes Using a Non-magnetic, Extreme Ultraviolet Sensor Array[1] J.P. LEVESQUE, J.W. BROOKS, R.N. CHANDRA, BOTING LI, M.E. MAUEL, G.A. NAVRATIL, A. SAPERSTEIN, I.G. STEWART, Y. WEI, Columbia University, C. HANSEN, University of Washington — Mode control in tokamaks often utilizes nonaxisymmetric magnetic sensors and actuators near the plasma surface. Placing magnetic coils behind walls would improve their longevity in a reactor at the expense of reducing frequency response, while a light-based detector could still respond quickly and with greater spatial sensitivity. We present the first demonstration of kink mode feedback control using only non-magnetic sensors consisting of extreme ultraviolet (EUV) detector arrays. Sixty-four poloidal views measure internal and external mode dynamics via plasma emissivity. Singular Value Decomposition (SVD) of EUV measurements is used to establish a basis set for calculating amplitude and phase of rotating perturbations. The poloidal spectrum of applied fields can adapt to changing structure of emissivity in real time. Feedback is completed using a graphics processing unit (GPU)-based control system with a total latency of 22μs [1]. We observe mode suppression and amplification as a function of the applied feedback phase angle relative to measured emissivity fluctuations. The system can directly extend to real-time tomographic reconstructions for mode or equilibrium control using an appropriate series-expansion method.
[1]N. Rath et al., Rev. Sci. Instr. 85, 045114 (2014)

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Jeffrey Levesque
Columbia University

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