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Real-time Numerical Solution for the Plasma Response Matrix for Disruption Avoidance in ITER[1] ALEXANDER GLASSER, EGEMEN KOLEMEN, Princeton Plasma Physics Laboratory, A.H. GLASSER, Fusion Theory and Computation, Inc. — Real-time analysis of plasma stability is essential to any active feedback control system that performs ideal MHD disruption avoidance. Due to singularities and poor numerical conditioning endemic to ideal MHD models of tokamak plasmas, current state-of-the-art codes require serial operation, and are as yet inoperable on the sub-$\mathcal{O}$(1s) timescale required by ITER's MHD evolution time. In this work, low-toroidal-n ideal MHD modes are found in near real-time as solutions to a well-posed boundary value problem. Using a modified parallel shooting technique and linear methods to subdue numerical instability, such modes are integrated with parallelization across spatial and temporal parts, via a Riccati approach. The resulting state transition matrix is shown to yield the desired plasma response matrix, which describes how magnetic perturbations may be employed to maintain plasma stability. Such an algorithm may be helpful in designing a control system to achieve ITERs high-performance operational objectives.

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