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Model Predictive Control of the Current Profile and the Internal Energy of DIII-D Plasmas[1] M. LAURET, W. WEHNER, E. SCHUSTER, Lehigh U. — For efficient and stable operation of tokamak plasmas it is important that the current density profile and the internal energy are jointly controlled by using the available heating and current-drive (H&CD) sources. The proposed approach is a version of nonlinear model predictive control in which the input set is restricted in size by the possible combinations of the H&CD on/off states. The controller uses real-time predictions over a receding-time horizon of both the current density profile (nonlinear partial differential equation) and the internal energy (nonlinear ordinary differential equation) evolutions. At every time instant the effect of every possible combination of H&CD sources on the current profile and internal energy is evaluated over the chosen time horizon. The combination that leads to the best result, which is assessed by a user-defined cost function, is then applied up until the next time instant. Simulations results based on a control-oriented transport code illustrate the effectiveness of the proposed control method.

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