Category Number and Subject:

[   ] Theory   [X] Experiment

Using the TokSys Modeling and Simulation Environment to Design, Test and Implement Plasma Control Algorithms on DIII-D,* A.W. Hyatt, A.S. Welander, N.W. Eidietis, M.J. Lanctot, D.A. Humphreys, *GA* – The DIII-D tokamak has 18 independent poloidal field (PF) shaping coils and an independent Ohmic transformer coil system. This gives great plasma shaping flexibility and freedom but requires a complex control capability that imposes some form of constraint so that a given plasma shape and specification leads to uniquely determined PF shaping currents. One such constraint used is to connect most PF coils in parallel to a common bus, forcing the sum of those PF current to be zero. This constraint has many benefits, but also leads to instability where adjacent PF coils of opposite current can mutually increase, leading to local shape distortion when using the standard shape control algorithms. We will give examples of improved control algorithms that were extensively tested using the TokSys simulation suite available at DIII-D and then successfully implemented in practice on DIII-D. In one case using TokSys simulations to develop a control solution for a long sought plasma equilibrium saved several days of expensive tokamak operation time.