

Abstract Submitted  
for the DPP09 Meeting of  
The American Physical Society

**Remediating the Effects of Time Delays in Axisymmetric Plasma Controllers via Optimal Tuning and Predictor Augmentation<sup>1</sup>** REZA ARASTOO, EUGENIO SCHUSTER, Lehigh University, MICHAEL WALKER, General Atomics — Introducing extra time delays into the axisymmetric control loops of certain superconducting tokamaks can have significant detrimental consequences. This study exposes and quantifies these effects by focusing on plasma current and radial position control in a vertically-stable circular plasma in KSTAR. Delays in the power supplies, data acquisition, and vessel structure are taken into account. Extremum-seeking-based optimal tuning of PID controllers is proposed as a possible method for remediating the negative effects of time delays. In addition, an augmentation of the control loop by the introduction of a predictor is proposed to improve the performance of the time-delayed closed-loop system. It is shown that the proposed predictor is robust against uncertainties in the values of the delays. The dual-locus technique is employed to assess stability of the closed-loop systems in the presence of time delays.

<sup>1</sup>Supported by the NSF CAREER award program (ECCS-0645086).

Eugenio Schuster  
Lehigh University

Date submitted: 18 Jul 2009

Electronic form version 1.4