Abstract Submitted for the Fiftieth Annual Meeting
Division of Plasma Physics
November 17–21, 2008, Dallas, Texas

Category Number and Subject: 6.1.3 Plasma Control Systems or 5.6.2 DIII-D Tokamak

[X] Theory [] Experiment

Momentum Diffusivity Estimation via PDE-Constrained Optimization,* C. Xu, Y. Ou, E. Schuster, *Lehigh U.*, D.A. Humphreys, M.L. Walker, *General Atomics*, T.A. Casper, W.H. Meyer, *LLNL* – Several experiments around the world have demonstrated that plasma rotation can improve plasma stability and enhance confinement. It has been shown [1] that the critical rotation speed for stabilization is a function of the rotation profile shape, implying a radially distributed stabilizing mechanism. Modeling of the rotational profile dynamics is limited by poor knowledge of the momentum diffusivity coefficient. In this work we use toroidal angular velocity data from experiments where the torque is modulated using neutral beams, and we employ optimization techniques to estimate the momentum diffusivity coefficient for the angular momentum partial differential equation (PDE) that best fits the experimental data. To further investigate the nonlinear dependence of the momentum diffusivity on other physical variables such as temperatures and densities, we introduce techniques from nonlinear regression and machine learning.

[1] A.C. Sontag, et al., Nucl. Fusion **47**, 1005 (2007).

*Supported by the Pennsylvania Infrastructure Technology Alliance (PITA), the NSF CAREER award program (ECCS-0645086), and the US DOE under DE-FG02-92ER54141, DE-FC02-04ER54698, and DE-AC52-07NA27344.