Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Nonlinear Burn Control in Tokamaks using Heating, Non-axisymmetric Magnetic Fields, Isotopic fueling and Impurity injection.[1]
ANDRES PAJARES, EUGENIO SCHUSTER, Lehigh University — Plasma density and temperature regulation in future tokamaks such as ITER is arising as one of the main problems in nuclear-fusion control research. The problem, known as burn control, is to regulate the amount of fusion power produced by the burning plasma while avoiding thermal instabilities. Prior work in the area of burn control considered different actuators, such as modulation of the auxiliary power, modulation of the fueling rate, and controlled impurity injection. More recently, the in-vessel coil system was suggested as a feasible actuator since it has the capability of modifying the plasma confinement by generating non-axisymmetric magnetic fields. In this work, a comprehensive, model-based, nonlinear burn control strategy is proposed to integrate all the previously mentioned actuators. A model to take into account the influence of the in-vessel coils on the plasma confinement is proposed based on the plasma collisionality and the density. A simulation study is carried out to show the capability of the controller to drive the system between different operating points while rejecting perturbations.

[1]Supported by the US DOE under DE-SC0010661.

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Date submitted: 12 Jul 2016 Electronic form version 1.4