Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Model-based Linear Quadratic Integral Control Design for q-profile Shaping in EAST[1] ZIBO WANG, HEXIANG WANG, EUGENIO SCHUSTER, Lehigh University, YAO HUANG, ZHENGPING LUO, QIPING YUAN, BINGJIA XIAO, Institute of Plasma Physics, Chinese Academy of Sciences, DAVE HUMPHREYS, General Atomics — In order to achieve advanced modes of operation, characterized by confinement improvement and possible steady-state operation, control capabilities for shaping the spatial profile of the toroidal current density, or equivalently the safety factor q or the gradient of the poloidal magnetic flux, are essential. A linear quadratic integral (LQI) control-design approach has been followed in this work to further develop such control capabilities in EAST. The controllers, which have been designed based on a first-principles-driven control-oriented model of the poloidal magnetic flux profile evolution, have the capability of regulating several points of the q profile and its integral properties such as the internal inductance l_i. Moreover, by controlling the plasma current Ip and the powers of both the low frequency (2.45 GHz) and the high-frequency (4.60 GHz) lower hybrid wave sources, the controllers can also regulate β_N. Nonlinear simulations show that the controllers can effectively regulate a combination of $q(0.1)$, $q(0.5)$, $q(0.9)$, l_i and β_N. The proposed control laws have been implemented in the recently developed Profile Control category in the EAST Plasma Control System (PCS) with the ultimate goal of testing them experimentally.

[1]Supported by the US DOE under DE-SC0010537

Zibo Wang
Lehigh University

Date submitted: 01 Jul 2019 Electronic form version 1.4