Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Numerical optimization of perturbative coils for tokamaks[1]
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— Numerical optimization of coils which apply three dimensional (3D) perturbative fields to tokamaks is presented. The application of perturbative 3D magnetic fields in tokamaks is now commonplace for control of error fields, resistive wall modes, resonant field drive, and neoclassical toroidal viscosity (NTV) torques. The design of such systems has focused on control of toroidal mode number, with coil shapes based on simple window-pane designs. In this work, a numerical optimization suite based on the STELLOPT 3D equilibrium optimization code is presented. The new code, IPECOPT, replaces the VMEC equilibrium code with the IPEC perturbed equilibrium code, and targets NTV torque by coupling to the PENT code. Fixed boundary optimizations of the 3D fields for the NSTX-U experiment are underway. Initial results suggest NTV torques can be driven by normal field spectrums which are not pitch-resonant with the magnetic field lines. Work has focused on driving core torque with $n = 1$ and edge torques with $n = 3$ fields. Optimizations of the coil currents for the planned NSTX-U NCC coils highlight the code's free boundary capability.

[1]This manuscript has been authored by Princeton University under Contract Number DE-AC02-09CH11466 with the U.S. Department of Energy.

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Date submitted: 03 Jul 2014 Electronic form version 1.4