Abstract Submitted
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Optimization of 3D Field Design[1] NIKOLAS LOGAN, PPPL, CAOXIANG ZHU, USTC — Recent progress in 3D tokamak modeling is now leveraged to create a conceptual design of new external 3D field coils for the DIII-D tokamak. Using the IPEC dominant mode as a target spectrum, the Finding Optimized Coils Using Space-curves (FOCUS) code optimizes the currents and 3D geometry of multiple coils to maximize the total set's resonant coupling. The optimized coils are individually distorted in space, creating toroidal "arrays" containing a variety of shapes that often wrap around a significant poloidal extent of the machine. The generalized perturbed equilibrium code (GPEC) is used to determine optimally efficient spectra for driving total, core, and edge neoclassical toroidal viscosity (NTV) torque and these too provide targets for the optimization of 3D coil designs. These conceptual designs represent a fundamentally new approach to 3D coil design for tokamaks targeting desired plasma physics phenomena. Optimized coil sets based on plasma response theory will be relevant to designs for future reactors or on any active machine. External coils, in particular, must be optimized for reliable and efficient fusion reactor designs.

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