

Design and optimization of a quasi-axisymmetric stellarator with permanent magnets

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Permanent magnets have recently been proposed as a means of simplifying the design of optimized stellarators. As a test of this concept, we present the physics and engineering design of a mid-scale quasi-axisymmetric stellarator for which the confining magnetic field is produced by a combination of planar toroidal-field coils and an array of permanent magnets. Each magnet is a cube of uniform dimensions and one of three unique polarization orientations. The plasma equilibrium for which the magnets are designed is similar to that of the NCSX stellarator but with a magnetic field on axis of approximately 0.5 T. We describe the procedures that we have developed for designing and optimizing the permanent magnet array, as well as the design of support structures for holding the permanent magnets in place.