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Magnetic Properties of 3D Printed Toroids LINDSEY BOLLIG, AUSTIN OTTO, PETER HILPISCH, GREG MOWRY, BRITTANY NELSON-CHEESEMAN, School of Engineering, University of St. Thomas, RENEWABLE ENERGY AND ALTERNATIVES LAB (REAL) TEAM — Transformers are ubiquitous in electronics today. Although toroidal geometries perform most efficiently, transformers are traditionally made with rectangular cross-sections due to the lower manufacturing costs. Additive manufacturing techniques (3D printing) can easily achieve toroidal geometries by building up a part through a series of 2D layers. To get strong magnetic properties in a 3D printed transformer, a composite filament is used containing Fe dispersed in a polymer matrix. How the resulting 3D printed toroid responds to a magnetic field depends on two structural factors of the printed 2D layers: fill factor (planar density) and fill pattern. In this work, we investigate how the fill factor and fill pattern affect the magnetic properties of 3D printed toroids. The magnetic properties of the printed toroids are measured by a custom circuit that produces a hysteresis loop for each toroid. Toroids with various fill factors and fill patterns are compared to determine how these two factors can affect the magnetic field the toroid can produce. These 3D printed toroids can be used for numerous applications in order to increase the efficiency of transformers by making it possible for manufacturers to make a toroidal geometry.

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