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New Parameterization of Tokamak Flux-Surface Equilibria[1] RYAN ARBON, Princeton University, JEFF CANDY, EMILY BELLI, General Atomics —
Equilibrium force-balance in a tokamak gives rise to toroidally-symmetric magnetic flux surfaces throughout the plasma volume. The calculation of this equilibrium is routinely carried out using codes such as the EFIT code. The solution from EFIT is given in the form of a flux field on a two-dimensional (R,Z) mesh. This toroidal equilibrium solution is required as an input to kinetic turbulence and transport codes. However, for use in these codes, a parameterized form of the flux-surface geometry is required. One popular model parameterization is the D-shaped formula, which characterizes the flux surface in terms of the elongation, triangularity, squareness, etc. In this work, we develop a new, more systematic approach for this parameterization. The method more accurately represents the flux surface geometry in the plasma edge, near the X-point, where the shaping is strongly non-circular and close to singular. The parameterization also forms the basis of a new inverse Grad-Shafranov solver to compute the equilibrium given the shape of a boundary magnetic surface.

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