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DESC: An Efficient Stellarator Equilibrium Code DANIEL DUDT, EGEMEN KOLEMEN, Princeton University — Calculating ideal magnetohydrodynamic equilibria is not trivial in non-axisymmetric devices, and the existing three-dimensional equilibria codes are not adequate for future stellarator demands. This presentation showcases the new code DESC, which is being developed with the unique challenges of stellarator optimization in mind. Instead of the popular energy principle approach, this new technique directly solves the equilibrium force balance equations at discrete points in real space. Through its novel use of pseudo-spectral methods, DESC properly resolves the magnetic axis and can achieve similar levels of accuracy with fewer independent variables than other codes. The nonlinear system of equations that describe an equilibrium can be solved with routine Newton algorithms that converge quadratically. Furthermore, this formulation provides an easy way to find branches of neighboring equilibria and could be used as a tool to efficiently search for quasi-symmetric stellarators. In its current version, DESC solves fixed-boundary equilibria and assumes the existence of nested flux surfaces. An overview of the code is presented along with example equilibria calculations and benchmarks against VMEC. Directions for further development are also discussed.

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