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Current drive in toroidal geometry driven by external helical electrostatic perturbations RICHARD NEBEL, Tibbar Technologies, DANIEL BARNES, Coronado Consulting, JOHN FINN, Los Alamos National Laboratory — Simulation results are shown for a plasma with an initial magnetic field $B_z = const.$ when helical external electrostatic fields are applied with zero radial magnetic field at the edge. These simulations, with the DEBS code, show that the external electrostatic perturbations $\epsilon = \phi(r_{wall})$ with $(m = 1, n = 1)$ have little effect inside the plasma below a certain threshold in ϵ; however, above this bifurcation they lead to a novel single helicity nonlinear state with low shear $q \approx 1$ in the interior, in spite of having zero net helicity injection. These states have net parallel current due to the lower electrical conductivity near the plasma edge. This steady state operation has elliptic field lines (O-lines), allowed by helical symmetry (stellarator transform.) Similar states have been observed with the application of helicities $(2, 1)$,$(1, 2)$, and $(1, 4)$. These simulation results are compared with experimental results recently found on the Tibbar Technologies device.

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