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Shearless bifurcations in particle transport for reversed-shear tokamaks

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G.C. Grime , M. Roberto, R.L. Viana , Y. Elskens  and I.L. Caldas



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Abstract

Some internal transport barriers in tokamaks have been related to the vicinity of extrema of the plasma equilibrium profiles. This effect is numerically investigated by considering the guiding-centre trajectories of plasma particles undergoing $\mathbf{E} \times \mathbf{B}$ drift motion, considering that the electric field has a stationary non-monotonic radial profile and an electrostatic fluctuation. In addition, the equilibrium configuration has a non-monotonic safety factor profile. The numerical integration of the equations of motion yields a symplectic map with shearless barriers. By changing the safety factor profile parameters, the appearance and breakup of these shearless curves are observed. The shearless curve's successive breakup and recovery are explained using concepts from bifurcation theory. We also present bifurcation sequences associated with the creation of multiple shearless curves. Physical consequences of scenarios with multiple shearless curves are discussed.

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