Symplectic Maps in Tokamaks with Poloidal Divertor

Geraldo Roberson[1], **Marisa Roberto[1]**, Iberê L.Caldas[2]
[1]*Physics Department, Aeronautic Institute of Technology, S.J.Campos, Brazil*
[2]*Physics Institute, University of São Paulo, Brazil*

In this work we developed a two-dimensional symplectic map associated with a Hamiltonian to describe the magnetic field lines in a tokamak plasmas with a single-null poloidal divertor, based on the methodology described in ref. [1]. This method allows free choice of parameters which can reproduce a wide variety of invariant magnetic surfaces. The safety factor can be chosen freely, since it does not depend on geometric parameters. The developed map is more elaborated than those described in refs. [2] and [3], being capable of reproducing magnetic surfaces with no restriction of triangularity and elongation. The integrable map was perturbed by an impulsive perturbation that describes non-axisymmetric magnetic resonances at the plasma edge. This perturbed map is applied to study the magnetic footprints on the tokamak divertor plate and the associated field line connection lengths. Moreover, to analyze the observed escape of the field lines toward the wall, we can apply this map with safety factor profiles taken from experimental devices. The maps presented in this work can complement analyses performed by time consuming numerical integration of magnetic field lines.

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