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Alfvén eigenmodes with magnetic islands

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The existence of flux surfaces is only guaranteed in idealised toroidally axisymmetric configurations. With the loss of symmetry and thus integrability, the field lines can tangle around a fixed point, creating so-called magnetic islands, or when multiple islands overlap, regions of field line chaos. Broken toroidal symmetry is introduced deliberately, through the use of resonant magnetic perturbation (RMP) coils [1], to suppress large explosive instabilities known as edge localised modes (ELMs) [2]. Apart from tokamaks that are axisymmetric by design, "stellarators", which are the leading alternative to the tokamak, have their confining magnetic field mostly produced by external current-carrying coils.

The impact of symmetry-breaking fields on Alfvén eigenmodes is an emerging research topic. In this work, we will demonstrate a numerical computation of the Alfvén eigenmodes with magnetic islands in generalized straight-field-line coordinates defined on island chains [3]. We compare the results with existing analytical calculations [4,5] and show calculations in more realistic geometries.

References

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