Modification of resistive tearing growth rate by equilibrium flow

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The resistive tearing instability has been a well-studied phenomenon since its discovery by Furth, Killeen and Rosenbluth (1963). In recent years, it has attracted renewed attention due to its possibly key role in triggering magnetic reconnection and the conversion of magnetic energy into thermal or kinetic energy. This reconnection and energy conversion in turn lead to eruptive events such as solar flares in the solar corona or the disruption of plasma confinement in tokamak devices. Since many realistic plasma configurations also feature an equilibrium flow, and it has been shown that such background flows can affect the tearing mode growth rate (Hofmann 1975, Paris and Sy 1983, Chen & Morrison 1990), it is important to understand when flow exerts a stabilising or destabilising influence, and to what extent.

Using the modern linear 1D magnetohydrodynamic spectral code *Legolas* (Claes *et al.* 2020, see also https://legolas.science), we perform a parametric study for two different magnetic field configurations in a plasma slab. In the first case, we consider a rotating magnetic field of fixed size, whilst in the second case we study a Harris sheet setup. Either magnetic field can be paired with different velocity profiles. In particular, we differentiate between velocity profiles with and without an inflexion point. For these cases, we identify the relevant parameters, which include, but are not limited to, flow speed, plasma-β, and the angle between flow and wavevector, which contribute to the relation between flow and magnetic shear. This parametric study serves as a first step in identifying the combined effects of equilibrium flow, magnetic shear and finite resistivity on the linear MHD spectrum.

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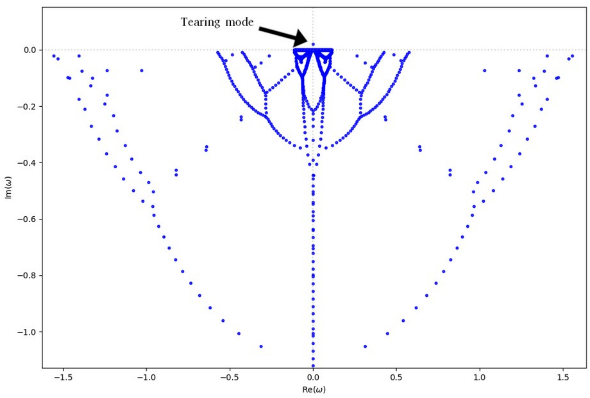

Figure: *Legolas* spectrum for a rotating magnetic field and a linear flow profile featuring a tearing mode.