Determining role of Krein signature for 3D Arnold tongues of oscillatory dynamos

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Using a homotopic family of boundary eigenvalue problems for the mean-field α^2-dynamo with helical turbulence parameter $\alpha(r) = \alpha_0 + \gamma\Delta\alpha(r)$ and homotopy parameter $\beta \in [0, 1]$, we show that the underlying network of diabolical points for Dirichlet (idealized, $\beta = 0$) boundary conditions substantially determines the choreography of eigenvalues and thus the character of the dynamo instability for Robin (physically realistic, $\beta = 1$) boundary conditions. In the $(\alpha_0, \beta, \gamma)-$space the Arnold tongues of oscillatory solutions at $\beta = 1$ end up at the diabolical points for $\beta = 0$. In the vicinity of the diabolical points the space orientation of the 3D tongues, which are cones in first-order approximation, is determined by the Krein signature of the modes involved in the diabolical crossings at the apexes of the cones. The Krein space induced geometry of the resonance zones explains the subtleties in finding α-profiles leading to spectral exceptional points, which are important ingredients in recent theories of polarity reversals of the geomagnetic field.