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Numerical Analysis of Drift Resistive Inertial Ballooning Modes[1]

A.H. KRITZ, V. TANGRI, T. RAFIQ, Lehigh University, A.Y. PANKIN, Tech-X Corp. — Three numerical techniques employing differentiation matrices are used to investigate the linear analysis of drift resistive inertial ballooning modes (DRIBM). The techniques applied avoid numerical stability issues associated with the frequently used shooting method. Hermite and Sinc spectral methods and a finite difference method are applied to compute the DRIBM eigenvalues and eigenvectors. It is shown that the spectral methods converge more rapidly than the finite difference method. In the DRIBM, model incorporated in the Multi-Mode transport model, the strong ballooning approximation is used [T. Rafiq *et. al.,* Phys. Plasmas **20**, 032506 (2013)]; whereas, in the numerical analysis of these modes presented here, a strong ballooning limit approximation is not utilized. It is shown that for conditions appropriate for the edge region of a DIII-D plasma (where contributions to transport associated with DRIBM are significant), the Multi-mode DRIBM component (utilizing a strong ballooning limit) and the numerical analysis that does not involve a strong ballooning approximation yield similar growth rates for the most unstable mode. This result follows from the fact that in the tokamak edge region the ballooning modes are strongly localized. The techniques utilized in this paper for calculating eigenvalues are quite general and are relevant to investigate other modes that can be analyzed using the ballooning mode formalism.

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