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Energy principle for a gyrofluid model and variational description of collisionless tearing modes[1] MAKOTO HIROTA, Tohoku University, PHILIP J. MORRISON, University of Texas at Austin — Linear stability of a four-field gyrofluid model is investigated by formulating the corresponding "energy principle", which is well-known as an established tool for ideal magnetohydrodynamic (MHD) stability. By assuming static equilibria (no flow as well as no diamagnetic drift), the eigenvalue problem is shown to be self-adjoint and the most unstable mode can be found by minimizing a potential energy. The process of deriving this energy principle differs in many respects from the direct application of the energy-Casimir method. It can be shown by the energy principle that the ion's compressibility effect tends to diminish the growth rate (as is the case with ideal MHD) whereas the finite-Larmor-radius effect tends to enhance it. On the other hand, the stability boundary is not affected by them but determined by the incompressible-MHD potential energy with a destabilizing effect of the electron inertia. This energy principle is applied to collisionless tearing modes. By substituting a simple trial function that includes only two parameters and minimizing the potential energy with respect to them, the estimated growth rate is found to agree with the dispersion relations derived by asymptotic matching. The parameters are, in fact, related to the widths of two nested inner layers.

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