EFTC 2017
17th European Fusion Theory Conference
9 - 12 October 2017, Athens - Greece

Stability criteria of magnetohydrodynamic plasmas and their underlying Hamiltonian structure

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Stability conditions of magnetized plasma flows are described by exploiting the Hamiltonian structure of the ideal magnetohydrodynamics equations using three kinds of energy principles that differ from each other being formulated either in Eulerian or Lagrangian variables and, most importantly because they impose different physical constraints on the allowed perturbations.

Specific features of the stability analysis are underlined and in particular:

1. the use of the time-dependent variable relabeling for equilibria with flows described in terms of Lagrangian variables, and
2. the relationship between the different classes of allowed perturbations and their implications on the stability conditions.

Two applications are presented: stratified convection and rotating pinch equilibrium configurations. The former example emphasizes the role played by entropy while the later demonstrates the utility of the relabeling transformation.

References

[1] T. Andreussi, P. J. Morrison, and F. Pegoraro, Phys. Plasmas 23, 102112 (2016)
[2] T. Andreussi, P. J. Morrison, and F. Pegoraro, Phys. Plasmas 22, 039903 (2015)
[3] T. Andreussi, P. J. Morrison, and F. Pegoraro, Phys. Plasmas 20, 092104 (2013)
[4] T. Andreussi, P. J. Morrison, and F. Pegoraro, Phys. Plasmas 19, 052102 (2012)
[5] T. Andreussi, P. J. Morrison, and F. Pegoraro, Plasma Phys. Control. Fusion, 52, 055001 (2010)