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A three function variational principle for stationary non-barotropic magnetohydrodynamics

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Variational principles for magnetohydrodynamics were introduced by previous authors both in Lagrangian and Eulerian form. In this paper we introduce simpler Eulerian variational principles from which all the relevant equations of non-barotropic stationary magnetohydrodynamics can be derived for surface covering field topologies. This is thus a generalization of a similar variational principle for stationary barotropic magnetohydrodynamics which was previously introduced. The variational principle is given in terms of only three independent functions for stationary non-barotropic flows. This is a smaller number of variables than the eight variables which appear in the standard equations of non-barotropic magnetohydrodynamics which are the magnetic field B , the velocity field v , the specific entropy s and the density ρ . The three functions are two surfaces χ and η the intersection of which are the magnetic field lines. And an additional function which varies along the magnetic field lines the magnetohydrodynamic metage μ (however, its surfaces are generally not orthogonal to the field lines). We further investigate the case in which the flow along magnetic lines is not ideal, and we transport phenomena along the temperature gradients.

Biography

Asher Yahalom is a Full Professor and the former Vice Dean in the Faculty of Engineering at Ariel University and the Academic director of the free electron laser user center which is located within the University Center campus. He was born in Israel on November 15, 1968, received the B.Sc., M.Sc. and Ph.D. degrees in mathematics and physics from the Hebrew University in Jerusalem, Israel in 1990, 1991 and 1996 respectively. Asher Yahalom was a postdoctoral fellow (1998) in the department of electrical engineering of Tel-Aviv University, Israel. And a Visiting Professor at the University of Cambridge, UK during the years 2005-2006, 2008, 2012. He was a visiting Professor at Princeton University, USA during the years 2019-2020.