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Variational approach to collisionless magnetic reconnection MAKOTO HIROTA, Japan Atomic Energy Agency, PHILIP J. MORRISON, The University of Texas at Austin — In collisionless regimes, magnetic reconnection may be accelerated by the mesoscopic effects which play the role of the singular perturbation to the ideal MHD model. Several authors have recently performed noncanonical Hamiltonian formulations of such extended MHD models, for which the dynamical systems approach is expected to provide further understandings of linear and nonlinear reconnection processes. This work focuses on the effect of electron inertia and develops the variational principle for a 2D fluid model including it. By introducing the displacement field of ideal plasma motion, the perturbation expansion around equilibrium state leads to a 2nd-order potential energy (δW). The linear growth rate of the reconnecting mode can be reproduced in the same manner as the MHD energy principle. Moreover, the recent perturbation method for deriving 3rd-order potential energy [M. Hirota, J. Plasma Phys. at press 2011] applies to this dynamical system, which can predict the early nonlinear phase of the reconnecting mode accompanied by a relaxation of the equilibrium state and mode-mode couplings.

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