

Dynamical Systems Theory in Material Instabilities

Peter B. Beda

HAS-BUTE Research Group on Dynamics of Machines and Vehicles, Budapest University of Technology and Economics, Budapest, Hungary

The study of instability in plastic solid continua can be traced back to Drucker and Hill and has re-appeared at Rice on shear bands. Since then there are a lot of papers published and several stability definitions are applied. These can be originated in either energy or kinematic conditions. The way of stability analysis is mainly determined by such definitions. This paper uses Lyapunov stability. Then a set of partial differential equations is derived from the fundamental field equations of continuum mechanics. These are interpreted as an infinite dimensional dynamical system for basic functions satisfying the boundary conditions. Lyapunov's indirect method is applied for that system. By using our methodology a few material instability phenomena are studied: strain localization, flutter, and a kind of mathematical interpretation can be obtained. It makes possible to explain the origin of mesh dependence in numerical studies of post-localization and the role of internal length.

[View the extended summary](#)