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9. Ordinary Differential Equations and Dynamical Systems

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Antiplane Shear Instability in Elastodynamics with Slip Dependent Friction

We study the initiation of unstable processes in antiplane elastodynamics, with application to earthquakes mechanics. Two elastic half-planes are supposed to be in contact. On a finite part of their common boundary (the fault) a slip-weakening friction law is imposed. For such boundary conditions, initial perturbations may develop as solutions with exponential time growth. These instabilities are relevant for eathquake predictions, being the mathematical representation of the rupture initiation phase. The existence of such solutions is analysed for different values of the involved parameters. The method consists of the transformation of the problem concerning the dominant part of the solution, which grows exponentially in time, into an integro-differential equation for which an existence analysis is performed.