

LOCAL AND GLOBAL INSTABILITY OF FLUID-CONVEYING PIPES ON ELASTIC FOUNDATIONS

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We investigate the relationship between the local and global bending motion of fluid conveying pipes on an elastic foundation. The local approach refers to an infinite pipe without taking into account its finite ends while in the global approach we consider a pipe of finite length with a given set of boundary conditions. Several kinds of propagating disturbances are identified from the dispersion relation, namely evanescent, neutral and unstable waves. As the length of the pipe is increased, the global criterion for instability is found to coincide with local neutrality, whereby a local harmonic forcing only generates neutral waves. For sets of boundary conditions that give rise only to static instabilities, the criterion for global instability of the long pipe is that static neutral waves exist. Conversely, for sets of boundary conditions that allow dynamic instabilities, the criterion for global instability of the long pipe is the existence of neutral waves of finite non-zero frequency. These results are discussed in relation with the work of Kulikovskii and other similar approaches in hydrodynamic stability theory.
