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Instability of distributed non-conservative systems, induced by small dissipation. (Russian)

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From the text (translated from the Russian): “We study the effect of small dissipation on the stability of distributed nonconservative systems. We construct a theory that qualitatively and quantitatively describes the ‘destabilization paradox’ in such systems, which is manifested as a sharp drop in the critical load and the critical frequency when small dissipative forces are taken into account. This theory is based on an analysis of bifurcations of multiple eigenvalues of parameter-dependent nonselfadjoint differential operators. We obtain new formulas that describe the splitting of multiple eigenvalues with Keldysh chains of arbitrary length for linear differential operators. We show that the ‘destabilization paradox’ is associated with a small-dissipation perturbation of a double eigenvalue of a circulatory system with a Keldysh chain of length 2. We derive formulas that describe the behavior of the eigenvalues of a nonconservative system when the load and the dissipation parameters are varied. We find explicit expressions for the jumps in the critical load and the critical frequency of stability loss. We obtain approximations of the asymptotic stability domain in the parameter space of the system. We determine the effect of stabilization of a distributed circulatory system by small dissipative forces, which consists in an increase of the critical load, and we derive the stabilization conditions. As a mechanical example, we study the problem of the stability of a viscoelastic rod with small external and internal friction under the action of a follower force. We obtain an analytic formula for the critical load as a function of the parameters of external and internal friction.”