DYNAMIC INSTABILITIES

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CONTENTS

1. Introduction to dynamic stability.

2. Stability concepts and definitions. Stable, asymptotically stable, unstable. Lyapunov stability. Divergence and flutter. Dynamical systems. Time and phase plane responses. Nodes, saddles, foci, and centers. Local and global stability.

3. Classical stability applications. Structural buckling. Discrete model applications. Methodology: equilibrium, stability analysis, local motions, global motions.

4. Continuous models: beams, plates, arches. Eigenvalue problems. Dynamic column buckling. Imperfection sensitivity. Displacement versus force control. Role of elastic foundation on buckling wavenumber. Nonlinear problems: elastica.
Energy methods. Hamilton's principle. Virtual work.

5. Nonconservative systems. Follower loads: Beck's problem.

6. Gyroscopic systems, models, and applications. Axially-moving materials. Rotating machine components. Discrete and continuous models. Critical speed instability. Supercritical speed behavior.

7. Parametric excitation. Mathieu's equation. Perturbation methods. Principal and higher-order resonances. Influence of damping. Floquet theory. Point mapping.

8. Special topics. Shell buckling. Variational methods.