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Stability of Nonlinear Control Systems - Lefschetz 1965-01-01
Stability of Nonlinear Control Systems
Control of Spacecraft and Aircraft - Arthur E. Bryson Jr. 2015-11-03
Here a leading researcher provides a comprehensive treatment of the design of automatic control logic for spacecraft and aircraft. In this book Arthur Bryson describes the linear-quadratic-regulator (LQR) method of feedback control synthesis, which coordinates multiple controls, producing graceful maneuvers comparable to those of an expert pilot. The first half of the work is about attitude control of rigid and flexible spacecraft using momentum wheels, spin, fixed thrusters, and gimbaled engines. Guidance for nearly circular orbits is discussed. The second half is about aircraft attitude and flight path control. This section discusses autopilot designs for cruise, climb-descent, coordinated turns, and automatic landing. One chapter deals with controlling helicopters near hover, and another offers an introduction to the stabilization of aeroelastic instabilities. Throughout the book there is a strong emphasis on the mathematical modeling necessary for designing a good feedback control system. The appendixes summarize analysis of linear dynamic systems, synthesis of analog and digital feedback control, simulation, and modeling of flexible vehicles.

Nonlinear Physical Systems - Oleg N. Kirillov 2013-12-11
Bringing together 18 chapters written by leading experts indynamical systems, operator theory, partial differential equations,and solid and fluid mechanics, this book presents state-of-the-artapproaches to a wide spectrum of new and challenging stabilityproblems. Nonlinear Physical Systems: Spectral Analysis, Stability andBifurcations focuses on problems of spectral analysis, stabilityand bifurcations arising in the nonlinear partial differentialequations of modern physics. Bifurcations and stability of solitarywaves, geometrical optics stability analysis in hydro- andmagnetohydrodynamics, and dissipation-induced instabilities aretreated with the use of the theory of Krein and Pontryagin space,index theory, the theory of multi-parameter eigenvalue problems andmodern asymptotic and perturbative approaches. Each chapter contains mechanical and physical examples, and thecombination of advanced material and more tutorial elements makesthis book attractive for both experts and non-specialists keen toexpand their knowledge on modern methods and trends in stabilitytheory. Contents 1. Surprising Instabilities of Simple Elastic Structures, DavideBigoni, Diego Misseroni, Giovanni Noselli and DanieleZaccaria. 2. WKB Solutions Near an Unstable Equilibrium and Applications,Jean-François Bony, Setsuro Fujiié, Thierry Ramond andMaher Zerzeri, partially supported by French ANR projectNOSEVOL. 3. The Sign Exchange Bifurcation in a Family of Linear HamiltonianSystems, Richard Cushman, Johnathan Robbins and DimitriiSadovskii. 4. Dissipation Effect on Local and Global Fluid-ElasticInstabilities, Olivier Doaré. 5. Tunneling, Librations and Normal Forms in a Quantum Double Wellwith a Magnetic Field, Sergey Yu. Dobrokhotov and Anatoly Yu.Anikin. 6. Stability of Dipole Gap Solitons in Two-Dimensional LatticePotentials, Nir Dror and Boris A. Malomed. 7. Representation of Wave Energy of a Rotating Flow in Terms of theDispersion Relation, Yasuhide Fukumoto, Makoto Hirota and YouichiMie. 8. Determining the Stability Domain of Perturbed Four-DimensionalSystems in 1:1 Resonance, Igor Hoveijn and Oleg N. Kirillov. 9. Index Theorems for Polynomial Pencils, Richard Kollár andRadomír Bosák. 10. Investigating Stability and Finding New Solutions inConservative Fluid Flows Through Bifurcation Approaches, PaoloLuzzatto-Fegiz and Charles H.K. Williamson. 11. Evolution Equations for Finite Amplitude Waves in ParallelShear Flows, Sherwin A. Maslowe. 12. Continuum Hamiltonian Hopf Bifurcation I, Philip J. Morrisonand George I. Hagstrom. 13. Continuum Hamiltonian Hopf Bifurcation II, George I. Hagstromand Philip J. Morrison. 14. Energy Stability Analysis for a Hybrid Fluid-Kinetic PlasmaModel, Philip J. Morrison, Emanuele Tassi and Cesare Tronci. 15. Accurate Estimates for the Exponential Decay of Semigroups withNon-Self-Adjoint Generators, Francis Nier. 16. Stability Optimization for Polynomials and Matrices, Michael L.Overton. 17. Spectral Stability of Nonlinear Waves in KdV-Type EvolutionEquations, Dmitry E. Pelinovsky. 18. Unfreezing Casimir Invariants: Singular Perturbations GivingRise to Forbidden Instabilities, Zensho Yoshida and Philip J.Morrison. About the Authors Oleg N. Kirillov has been a Research Fellow at theMagneto-Hydrodynamics Division of the Helmholtz-ZentrumDresden-Rossendorf in Germany since 2011. His research interestsinclude non-conservative stability problems of structural mechanicsand physics, perturbation theory of non-self-adjoint boundaryeigenvalue problems, magnetohydrodynamics, friction-induceddoscillations, dissipation-induced instabilities and non-Hermitianproblems of optics and microwave physics. Since 2013 he has servedas an Associate Editor for the journal Frontiers in MathematicalPhysics. Dmitry E. Pelinovsky has been Professor at McMaster University inCanada since 2000. His research profile includes work withnonlinear partial differential equations, discrete dynamicalsystems, spectral theory, integrable systems, and numericalanalysis. He served as the guest editor of the special issue of thejournals Chaos in 2005 and Applicable Analysis in 2010. He is anAssociate Editor of the journal Communications in Nonlinear Scienceand Numerical Simulations. This book is devoted to the problems of spectral analysis,stability and bifurcations arising from the nonlinear partialdifferential equations of modern physics. Leading experts indynamical systems, operator theory, partial differential equations,and solid and fluid mechanics present state-of-the-art approachesto a wide spectrum of new challenging stability problems.Bifurcations and stability of solitary waves, geometrical opticsstability analysis in hydro- and magnetohydrodynamics anddissipation-induced instabilities will be treated with the use ofthe theory of Krein and Pontryagin space, index theory, the theoryof multi-parameter eigenvalue problems and modern asymptotic andperturbative approaches. All chapters contain mechanical andphysical examples and combine both tutorial and advanced sections,making them attractive both to experts in the field andnon-specialists interested in knowing more about modern methods andtrends in stability theory.