# Duality System in Applied Mechanics and Optimal Control (Advances in Mechanics and Mathematics)

*Wan-Xie Zhong*

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A unified approach is proposed for applied mechanics and optimal control theory. The Hamilton system methodology in analytical mechanics is used for eigenvalue problems, vibration theory, gyroscopic systems, structural mechanics, wave-guide, LQ control, Kalman filter, robust control etc. All aspects are described in the same unified methodology. Numerical methods for all these problems are provided and given in meta-language, which can be implemented easily on the computer. Precise integration methods both for initial value problems and for two-point boundary value problems are proposed, which result in the numerical solutions of computer precision.
Key Features of the text include:
-Unified approach based on Hamilton duality system theory and symplectic mathematics. -Gyroscopic system vibration, eigenvalue problems.
-Canonical transformation applied to non-linear systems.
-Pseudo-excitation method for structural random vibrations.
-Precise integration of two-point boundary value problems.
-Wave propagation along wave-guides, scattering.
-Precise solution of Riccati differential equations.
-Kalman filtering.
-HINFINITY theory of control and filter.

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