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Nota di contenuto	The Duffing Equation: Nonlinear Oscillators and their Behaviour; Contents; Contributors; Preface; 1 Background: On Georg Duffing and the Duffing equation; 1.1 Introduction; 1.2 Historical perspective; 1.3 A brief biography of Georg Duffing; 1.4 The work of Georg Duffing; 1.5 Contents of Duffing's book; 1.5.1 Description of Duffing's book; 1.5.2 Reviews of Duffing's book; 1.6 Research inspired by Duffing's work; 1.6.1 1918-1952; 1.6.2 1962 to the present day; 1.7 Some other books on nonlinear dynamics; 1.8 Overview of this book; References 2 Examples of physical systems described by the Duffing equation2.1 Introduction; 2.2 Nonlinear stiffness; 2.3 The pendulum; 2.4 Example of geometrical nonlinearity; 2.5 A system consisting of the pendulum and nonlinear stiffness; 2.6 Snap-through mechanism; 2.7 Nonlinear isolator; 2.7.1 Quasi-zero stiffness isolator; 2.8 Large deflection of a beam with nonlinear stiffness; 2.9 Beam with nonlinear stiffness due to

inplane tension; 2.10 Nonlinear cable vibrations; 2.11 Nonlinear electrical circuit; 2.11.1 The electrical circuit studied by Ueda; 2.12 Summary; References

3 Free vibration of a Duffing oscillator with viscous damping3.1 Introduction; 3.2 Fixed points and their stability; 3.2.1 Case when the nontrivial fixed points do not exist ( $> 0$ ); 3.2.2 Case when the nontrivial fixed points exist ( $< 0$ ); 3.2.3 Variation of phase portraits depending on linear stiffness and linear damping; 3.3 Local bifurcation analysis; 3.3.1 Bifurcation from trivial fixed points; 3.3.2 Bifurcation from nontrivial fixed points; 3.4 Global analysis for softening nonlinear stiffness ( $< 0$ ); 3.4.1 Phase portraits; 3.4.2 Global bifurcation analysis 3.5 Global analysis for hardening nonlinear stiffness ( $> 0$ )3.5.1 Phase portraits; 3.5.2 Global bifurcation analysis; 3.6 Summary; Acknowledgments; References; 4 Analysis techniques for the various forms of the Duffing equation; 4.1 Introduction; 4.2 Exact solution for free oscillations of the Duffing equation with cubic nonlinearity; 4.2.1 The frequency and period of free oscillations of the Duffing oscillator; 4.2.2 Discussion; 4.3 The elliptic harmonic balance method; 4.3.1 The Duffing equation with a strong quadratic term; 4.3.2 The Duffing equation with damping 4.3.3 The harmonically excited Duffing oscillator4.3.4 The harmonically excited pure cubic Duffing equation; 4.4 The elliptic Galerkin method; 4.4.1 Duffing oscillator with a strong excitation force of elliptic type; 4.5 The straightforward expansion method; 4.5.1 The Duffing equation with a small quadratic term; 4.6 The elliptic Lindstedt-Poincare method; 4.6.1 The Duffing equation with a small quadratic term; 4.7 Averaging methods; 4.7.1 The generalised elliptic averaging method; 4.7.2 Elliptic Krylov-Bogolubov (EKB) method for the pure cubic Duffing oscillator 4.8 Elliptic homotopy methods

## Sommario/riassunto

The Duffing Equation: Nonlinear Oscillators and their Behaviour brings together the results of a wealth of disseminated research literature on the Duffing equation, a key engineering model with a vast number of applications in science and engineering, summarizing the findings of this research. Each chapter is written by an expert contributor in the field of nonlinear dynamics and addresses a different form of the equation, relating it to various oscillatory problems and clearly linking the problem with the mathematics that describe it. The editors and the contributors explain the mathem