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Nota di contenuto	Nonlinear Laser Dynamics; Contents; Preface; List of Contributors; Part I Nanostructured Devices; 1 Modeling Quantum-Dot-Based Devices; 1.1 Introduction; 1.2 Microscopic Coulomb Scattering Rates; 1.2.1 Carrier-Carrier Scattering; 1.2.2 Detailed Balance; 1.3 Laser Model with Ground and Excited States in the QDs; 1.3.1 Temperature Effects; 1.3.2 Impact of Energy Confinement; 1.3.3 Eliminating the Excited State Population Dynamics; 1.4 Quantum Dot Switching Dynamics and Modulation Response; 1.4.1 Inhomogeneous Broadening; 1.4.2 Temperature-Dependent Losses in the Reservoir 1.4.3 Comparison to Experimental Results1.5 Asymptotic Analysis; 1.5.1 Consequences of Optimizing Device Performance; 1.6 QD Laser with Doped Carrier Reservoir; 1.7 Model Reduction; 1.8 Comparison to Quantum Well Lasers; 1.9 Summary; Acknowledgment; References; 2 Exploiting Noise and Polarization Bistability in Vertical-Cavity Surface-Emitting Lasers for Fast Pulse Generation and Logic Operations; 2.1 Introduction; 2.2 Spin-Flip Model; 2.3 Polarization Switching; 2.4 Pulse Generation Via Asymmetric Triangular Current Modulation; 2.5

Influence of the Noise Strength

2.6 Logic Stochastic Resonance in Polarization-Bistable VCSELs2.7 Reliability of the VCSEL-Based Stochastic Logic Gate; 2.8 Conclusions; Acknowledgment; References; 3 Mode Competition Driving Laser Nonlinear Dynamics; 3.1 Introduction; 3.2 Mode Competition in Semiconductor Lasers; 3.3 Low-Frequency Fluctuations in Multimode Lasers; 3.4 External-Cavity Mode Beating and Bifurcation Bridges; 3.5 Multimode Dynamics in Lasers with Short External Cavity; 3.6 Polarization Mode Hopping in VCSEL with Time Delay; 3.6.1 Polarization Switching Induced by Optical Feedback

3.6.2 Polarization Mode Hopping with Time-Delay Dynamics3.6.3 Coherence Resonance in a Bistable System with Time Delay; 3.7 Polarization Injection Locking Properties of VCSELs; 3.7.1 Optical Injection Dynamics; 3.7.2 Polarization and Transverse Mode Switching and Locking: Experiment; 3.7.3 Bifurcation Picture of a Two-Mode Laser; 3.8 Dynamics of a Two-Mode Quantum Dot Laser with Optical Injection; 3.9 Conclusions; Acknowledgments; References; 4 Quantum Cascade Laser: An Emerging Technology; 4.1 The Essence of QCLs; 4.1.1 Semiconductor Heterostructures; 4.1.2 Electric Pumping; 4.1.3 Cascading

4.2 Different Designs4.2.1 Optical Transition and Lifetime of the Upper State; 4.2.2 Effective Extraction from the Lower Laser Level; 4.2.3 Injection; 4.3 Reducing the Number of Levels Involved; 4.4 Modeling; 4.5 Outlook; Acknowledgments; 4.6 Appendix: Derivation of Eq. (4.1); References; 5 Controlling Charge Domain Dynamics in Superlattices; 5.1 Model of Charge Domain Dynamics; 5.2 Results; 5.2.1 Drift Velocity Characteristics for q = 0°, 25°, and 40°; 5.2.2 Current-Voltage Characteristics for q = 0°, 25°, and 40°; 5.2.3 I(t) Curves for q = 0°, 25°, and 40°

5.2.4 Charge Dynamics for q = 0°, 25°, and 40°

Sommario/riassunto

A distinctive discussion of the nonlinear dynamical phenomena of semiconductor lasers. The book combines recent results of quantum dot laser modeling with mathematical details and an analytic understanding of nonlinear phenomena in semiconductor lasers and points out possible applications of lasers in cryptography and chaos control. This interdisciplinary approach makes it a unique and powerful source of knowledge for anyone intending to contribute to this field of research.By presenting both experimental and theoretical results, the distinguished authors consider solitary lase