

Contents

1	Motivation and Outline	1
	References	3
2	Light Propagation in Nonlinear Periodic Media	5
2.1	Basic Equations of Wave Propagation in Nonlinear Optical Media	5
2.2	The Photorefractive Nonlinearity	7
2.2.1	The Linear Electrooptic Effect	8
2.2.2	The Band Transport Model	9
2.2.3	Isotropic Approximation	11
2.2.4	Anisotropic Model	12
2.3	Periodic Photonic Structures	13
2.3.1	Band Gap Spectrum	15
2.3.2	Linear Propagation	16
2.3.3	Nonlinear Propagation	17
	References	19
3	Optically Induced Photonic Lattices	21
3.1	The Optical Induction Technique	21
3.1.1	Experimental Realizations	23
3.2	Structure Analysis of the Induced Refractive Index Patterns	26
3.2.1	Waveguiding	26
3.2.2	Brillouin Zone Spectroscopy	26
3.2.3	Orientation Anisotropy	28
3.3	Hexagonal Lattices	30
	References	33
4	Resonant Rabi Oscillations and Interband Transitions	35
4.1	Introduction	35
4.2	The Landau-Zener-Majorana Model	36

4.3	Rabi Oscillations	39
4.3.1	Two-Level Rabi Oscillations	40
4.3.2	Three-Level Rabi Oscillations	46
4.4	Landau-Zener Tunneling	48
4.4.1	Symmetric Tunneling	51
4.4.2	Asymmetric Tunneling	53
4.5	Nonlinear Tunneling	55
	References	58
5	Nonlinear Light Localization	61
5.1	Solitons in Periodic Photonic Structures	61
5.1.1	Discrete and Gap Solitons	61
5.1.2	Discrete Vortex Solitons	64
5.2	Anisotropy-Controlled Stability of Discrete Vortex Solitons	66
5.3	Double-Charge Discrete Vortex Solitons	71
5.3.1	Focusing Nonlinearity	73
5.3.2	Defocusing Nonlinearity	77
5.4	Multivortex Solitons	80
	References	84
6	Summary and Outlook	87
	References	89
7	Appendices	91
7.1	Numerical Methods	91
7.1.1	Solving the Potential Equation	91
7.1.2	The Beam Propagation Method	92
7.1.3	Finding Solitary Solutions	93
7.2	Characterization of the Spatial Light Modulator	94
7.3	The Phase Imprinting Technique	96
	References	98
	Curriculum Vitae	99

Controlling Light in Optically Induced Photonic Lattices

Terhalle, B.

2011, X, 106 p., Hardcover

ISBN: 978-3-642-16646-4