

Contents

1	Scalar Reaction-Diffusion Equations: Conditional Symmetry, Exact Solutions and Applications	1
1.1	Nonlinear Reaction-Diffusion Equations in Mathematical Biology	1
1.2	Nonclassical Symmetry: Historical Review, Definitions and Properties	4
1.3	Examples of Q -Conditional Symmetries of Some Reaction-Diffusion Equations	9
1.4	Determining Equations for the General Reaction-Diffusion-Convection Equation	13
1.5	Q -Conditional Symmetry of Reaction-Diffusion-Convection Equations with Constant Diffusivity	17
1.6	Exact Solutions of Some Equations Arising in Biological Models	21
1.7	Q -Conditional Symmetry of Reaction-Diffusion-Convection Equations with Variable Diffusivity	33
1.8	Exact Solutions of Some Equations with Power-Law Diffusivity and Their Interpretation	36
1.9	Concluding Remarks	40
	References	41
2	Q-Conditional Symmetries of Reaction-Diffusion Systems	45
2.1	Reaction-Diffusion Systems and Their Applications	45
2.2	Q -Conditional Symmetry for Systems of Partial Differential Equations	48
2.3	Systems of Determining Equations	52
2.4	Conditional Symmetries of Reaction-Diffusion Systems with Constant Diffusivities	56
2.5	Conditional Symmetries of Reaction-Diffusion Systems with Power-Law Diffusivities	61
2.6	Concluding Remarks	72
	References	73

3	Conditional Symmetries and Exact Solutions of Diffusive Lotka–Volterra Systems	77
3.1	The Lotka–Volterra System and Its Application	77
3.2	The Two-Component Diffusive Lotka–Volterra System	79
3.2.1	Determining Equations	79
3.2.2	Q -Conditional Symmetry	82
3.2.3	Reductions to Systems of Ordinary Differential Equations and Exact Solutions	89
3.3	The Three-Component Diffusive Lotka–Volterra System	98
3.3.1	Lie Symmetry	99
3.3.2	Determining Equations	101
3.3.3	Q -Conditional Symmetry of the First Type	102
3.3.4	Exact Solutions and Their Interpretation	107
3.4	A Hunter–Gatherer–Farmer Population Model	112
3.5	Concluding Remarks	115
	References	117
4	Q-Conditional Symmetries of the First Type and Exact Solutions of Nonlinear Reaction-Diffusion Systems	119
4.1	Determining Equations	119
4.2	Reaction-Diffusion Systems with Constant Diffusivities	122
4.2.1	Q -Conditional Symmetry of the First Type	123
4.2.2	Reductions, Exact Solutions and Their Interpretation	132
4.3	Reaction-Diffusion Systems with Variable Diffusivities	137
4.3.1	Q -Conditional Symmetry of the First Type	137
4.3.2	Reductions and Exact Solutions	143
4.3.3	Application to a Physically Motivated Problem	145
4.4	Concluding Remarks	147
	References	151
A	List of Reaction-Diffusion Systems and Exact Solutions	155
	Index	157

Nonlinear Reaction-Diffusion Systems
Conditional Symmetry, Exact Solutions and their
Applications in Biology

Cherniha, R.; Davydovych, V.

2017, XIII, 160 p. 13 illus., 10 illus. in color., Softcover

ISBN: 978-3-319-65465-2