

CONTENTS

1. Linear waves	
1.1. Introduction	1
1.2. Linear wave equation: wave-terminology	1
1.3. General linear equation, dispersion relation	4
1.4. Dispersive waves: group velocity	6
1.5. General solution of the linear-wave equation	8
1.6. Propagation of energy in a dispersive wave	11
1.7. An important kinematical relation	13
Bibliography	14
Appendix I Saddle-point method	15
2. Some nonlinear equations of evolution (steady solution)	21
2.1. Introduction	21
2.2. Effect of nonlinearity	22
2.3. Diffusive waves	28
2.4. Dispersive waves	31
2.5. Solitary wave: solitons	37
2.6. Some other equations of evolution exhibiting solitons	38
Bibliography	41
Appendix IIA Equations governing duct flow and shallow water waves on uneven bed	46
Appendix IIB Reduction theory	51
3. Soliton interaction	61
3.1. Introduction	61
3.2. Properties of the Schrödinger equation	61
3.3. Integrals of equation and relationship between KdV equation and the Schrödinger equation	65
3.4. Time-independence of the eigenvalues of the Schrödinger equation, determination of scattering parameters	67
3.5. Inverse scattering problem	70
3.6. Soliton solution of the KdV equation	71
3.7. Soliton interaction	83
3.8. Continuous eigenvalues of the Schrödinger operator	88
Bibliography	88
4. General equation of evolution	91
4.1. Introduction	91
4.2. Definitions	94
4.3. Solitary-wave solution of the general equation of evolution	100

4.4 Application of the general theory to the KdV equation	104
4.5. Eigenspeeds of the general solution of the KdV equation	109
Bibliography	111
5. Group velocity: nonlinear waves	113
5.1. Introduction	113
5.2. Averaging procedure	114
5.3. Examples	117
5.4. The Korteweg–de Vries equation	125
5.5 Group Velocity: dynamical treatment	133
Bibliography	138
Author index	139
Subject index	141

