

## Contents

	<i>Preface</i>	page vii
	<i>Acknowledgments</i>	ix
1	The propagation of a disturbance in relation to imaging	1
	1.1 Background and motivation	1
	1.2 A propagating disturbance	3
	1.3 An example involving dissipation	5
	1.4 A non-linear example	10
	1.5 Heterogeneity and imaging	12
	1.6 Summary	26
2	Principles and equations governing fluid flow and deformation	27
	2.1 Introduction	27
	2.2 Underlying principles	27
	2.3 Deformation	40
	2.4 Elastic deformation	53
	2.5 Fluid flow	57
	2.6 Coupled deformation and fluid flow	76
	2.7 Summary	100
3	Trajectory-based modeling	101
	3.1 Introduction	101
	3.2 Series representation of a moving front	104
	3.3 The frequency domain and high-frequency approximations	106
	3.4 Asymptotic series and solutions	108
	3.5 Characteristics and trajectories	114
	3.6 Trajectory-based modeling: the wave equation	117
	3.7 Multiple scale asymptotics	123

vi	<i>Contents</i>	
4	Equations in diffusion form	131
4.1	Introduction	131
4.2	A high-frequency asymptotic solution	131
4.3	Applications	147
4.4	Summary	171
5	Equations governing advection and transport	172
5.1	Introduction	172
5.2	The governing equation	172
5.3	An asymptotic solution	174
5.4	The streamline approach for transport modeling	188
5.5	Applications	201
5.6	Summary and conclusions	219
6	Immiscible fluid flow	220
6.1	Introduction	220
6.2	Governing equations for two-phase flow	220
6.3	An asymptotic approach	226
6.4	Streamline modeling of immiscible fluid flow	233
6.5	Applications	264
6.6	Summary	284
7	Coupled deformation and fluid flow	285
7.1	Introduction	285
7.2	Deformation in a porous body containing a single fluid	286
7.3	A porous body containing three fluids	311
7.4	Application	317
7.5	Summary	326
8	Appendix: a guide to the accompanying software	327
8.1	Fronts3D: computing pressure propagation by Fast Marching	328
8.2	Trace3D: software for trajectory-based modeling and inversion	329
	<i>References</i>	336
	<i>Index</i>	349
	<i>Colour plate section between pages 150 and 151</i>	