

Jerrold Bebernes David Eberly

Mathematical Problems from Combustion Theory

With 14 Illustrations



Springer-Verlag
New York Berlin Heidelberg
London Paris Tokyo Hong Kong

Contents

Preface

1	Introduction	1
1.1	Basic Fluid Dynamics and Chemical Kinetics	1
1.2	Simplification of the System	6
1.3	Solid Fuel Models	7
1.4	Gaseous Fuel Models	9
1.5	Overview and Comments	13
2	Steady-State Models	15
2.1	Existence on General Domains	15
2.2	Radial Symmetry	21
2.3	Multiplicity in Special Domains	33
2.4	Solution Profiles	39
2.5	Comments	46
3	The Rigid Ignition Model	47
3.1	Existence-Uniqueness	48
3.2	Blowup: When?	53
3.3	Blowup: Where?	64
3.4	Blowup: How?	69
3.5	Comments	86
4	The Complete Model for Solid Fuel	88
4.1	Comparison Techniques	88
4.2	Invariance	94
4.3	Existence	98
4.4	Applications	103
4.5	Comments	106
5	Gaseous Ignition Models	107
5.1	The Reactive-Diffusive Ignition Model	107
5.2	The Abstract Linear Problem	108
5.3	The Abstract Perturbed Problem	113

5.4	The Radially Symmetric Case	115
5.5	Blowup: Where?	119
5.6	A Nondiffusive Reactive Model	125
5.7	Comments	127
6	Conservation Systems for Reactive Gases	129
6.1	A Nonreactive Model	129
6.2	Induction Model for a Reactive-Euler System	133
6.3	The Full One-Dimensional Gas Model	136
6.4	Energy Estimates and Density Bounds	140
6.5	Velocity Bounds	152
6.6	Temperature Bounds	157
6.7	Comments	160
References		162
Index		175