Contents

Part I Experimental and Numerical Techniques

1 Experimental Techniques 3
1.1 The Terminal Ballistics Lab 3
1.1.1 Laboratory Guns 3
1.1.2 Projectiles and Targets 5
1.1.3 Diagnostics for Terminal Ballistics 7
1.2 Determination of the Dynamic Properties 9
1.2.1 Equation of State Measurements 9
1.2.2 Dynamic Strength Measurements 12
1.2.3 Diagnostics 14
1.3 The Common Threats in Terminal Ballistics 23

2 Material Models for Numerical Simulations 27
2.1 General Description 27
2.2 Material Properties 29
2.2.1 The Equation of State 29
2.2.2 The Constitutive Relations 30
2.2.3 Failure of Ductile Materials 33
2.2.4 Failure of Brittle Materials 37
2.2.5 The Spall Failure 39

Part II Penetration Mechanics

3 Rigid Penetrators 45
3.1 The Mechanics of Deep Penetration 45
3.2 The Penetration Model for Rigid Long Rods 55
3.2.1 Impact at the Ordnance Velocity Range 56
3.2.2 High Velocity Impact: The Cavitation Phenomenon . . . 61
3.3 The Cavity Expansion Analysis 69
3.4 The Optimal Nose Shape 74

3.5 The Penetration of Short Projectiles 75
3.5.1 The Influence of the Entrance Phase 75
3.5.2 A Numerically Based Model for the Entrance Phase Effect 80
3.6 The Impact of Spheres 88
3.6.1 Rigid Sphere Impact 88
3.6.2 The Impact of Non-rigid Spheres 92
3.7 The Effect of Friction 95
3.8 Concrete Targets 97
3.9 The Deep Penetration of Deforming Rods 100
3.10 The Transition to Finite-Thickness Targets 107

4 Plate Perforation 109
4.1 General Description 109
4.2 The Perforation of Ductile Plates by Sharp Nosed Rigid Projectiles 111
4.3 Plate Perforation by Spherical Nosed Projectiles 128
4.4 Plate Perforation by Blunt Projectiles 131
4.5 Forced Shear Localization and Adiabatic Shear Failure 149
4.6 Perforation of Thin Plates at the Hypervelocity Regime 152

5 Eroding Penetrators 155
5.1 The Penetration of Shaped Charge Jets 156
5.2 The Penetration of Eroding Long Rods 159
5.2.1 The Allen–Rogers Penetration Model 161
5.2.2 The Alekseevskii-Tate Penetration Model 169
5.2.3 The Validity of the AT Model 175
5.2.4 The L/D Effect 181
5.2.5 Other Penetration Models 185
5.3 Scaling Issues in Terminal Ballistics 189
5.4 Penetration at the Hypervelocity Regime 196
5.5 Plate Perforation by Eroding Rods 201

Part III Defeat Mechanisms

6 Defeat by High Strength Targets 211
6.1 Definitions 211
6.2 Metallic Targets 212
6.3 Ceramics for Armor 217
6.3.1 Ceramics Against AP Projectiles 217
6.3.2 The Interaction of Ceramics with Long Rods 227
6.3.3 Numerical Simulations 235
6.3.4 Ceramics Against Shaped Charge Jets 242
6.4 Woven Fabrics as Armor Materials 245

7 Asymmetric Interactions 257
7.1 Defeating AP Projectiles 260
7.2 Defeating Long Rods 266
7.2.1 Perforation of Inclined Plates 266
7.2.2 Ricochet of Long Rods 267
7.2.3 The Interaction of Long Rods with Moving Plates 273
7.2.4 The Impact of Yawed Rods 281
7.3 Defeating Shaped Charge Jets 292
7.3.1 The Explosive Reactive Armor (ERA) 292
7.3.2 Passive Cassettes 300

References 307

Springer

http://www.springer.com/978-3-642-25304-1

Terminal Ballistics
Rosenberg, Z.; Dekel, E.
2012, XIV, 326 p., Hardcover
ISBN: 978-3-642-25304-1