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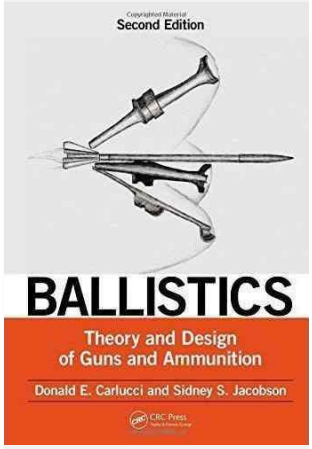
Book review

Ballistics: Theory and Design of Guns and Ammunition
Second Edition

Donald E. Carlucci and Sidney S. Jacobson



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The first edition of the book Ballistics: Theory and Design of Guns and Ammunition by authors Carlucci, D. E., & Jacobson, S. S. was issued in 2007. It dealt with the theoretical treatment of ballistics in a truly comprehensive way and shortly after its release the book was appreciated by numerous experts in ballistics.

Dr. Carlucci is an adjunct professor of mechanical engineering at the Stevens Institute of Technology where he teaches graduate classes on interior, exterior, and terminal ballistics, as well as undergraduate classes on engineering design.

Sidney S. Jacobson was a researcher, designer, and developer of ammunition and weapons at the U.S. Army's Picatinny Arsenal in New Jersey for 35 years. He retired in 1986, but he has still been involved in the field through teaching, consulting, and lecturing.

Currently the second edition of this book comes out, which deals with all three areas of ballistics – interior, exterior, and terminal ballistics, offering a seamless presentation of the complex phenomena occurring during the launch, flight, and impact of a projectile. The book also includes chapters on the weapon and ammunition design practice.

Naturally, the question arises what is new in the second edition. Authors have decided to add the topics concerning the probability of first round hit for direct fire weapons. A new section by Dr. Ernie Baker which discusses explosive equations of state for detonation physics modelling was also added. The chapter on wound ballistics was significantly updated. In addition,

computer examples in Mathcad are presented, as well as a section of colour plates, to help readers better visualize the physical concepts of ballistics.

The book covers the following fields:

Interior Ballistics: Ballistic Disciplines, Terminology, Physical Foundation of Interior Ballistics, The Ideal Gas Law, Other Gas Laws, Thermophysics and Thermochemistry, Thermodynamics, Combustion, Solid Propellant Combustion, Fluid Mechanics.

Analytic and Computational Ballistics: Computational Goal, Lagrange Gradient, Chambrage Gradient, Numerical Methods in Interior Ballistics, Sensitivities and Efficiencies.

Ammunition Design Practice: Stress and Strain, Failure Criteria, Ammunition Types, Propellant Ignition, The Gun Chamber, Propellant Charge Construction, Propellant Geometry, Cartridge Case Design, Projectile Design, Shell Structural Analysis, Buttress Thread Design Sabot Design.

Weapon Design Practice: Fatigue and Endurance, Tube Design, Gun Dynamics, Muzzle Devices and Associated Phenomena, Gun Dynamics Nomenclature.

Exterior Ballistics: Introductory Concepts, Dynamics Review, Trajectories, Vacuum Trajectory, Simple Air Trajectory (Flat Fire), Wind Effects on a Simple Air Trajectory, Generalized Point Mass Trajectory, Six Degree-of-Freedom (6-DOF) Trajectory, Modified Point Mass Trajectory.

Linearized Aeroballistics: Linearized Pitching and Yawing Motions, Gyroscopic and Dynamic Stabilities, Yaw of Repose, Roll Resonance.

Mass Asymmetries: Lateral Throwoff, Static Imbalance, Dynamic Imbalance.

Swerve Motion: Aerodynamic Jump, Epicyclic Swerve, Drift.

Nonlinear Aeroballistics: Nonlinear Forces and Moments, Bilinear and Trilinear Moments.

Terminal Ballistics: Penetration Theories, Penetration and Perforation of Metals, Penetration and Perforation of Concrete, Penetration and Perforation of Soils, Penetration and Perforation of Ceramics, Penetration and Perforation of Composites.

Shock Physics: Shock Hugoniots Rarefaction Waves, Stress Waves in Solids, Detonation Physics.

Introduction to Explosive Effects: Gurney Method, Taylor Angles, Mott Formula.

Shaped Charges: Shaped Charge Jet Formation, Shaped Charge Jet Penetration, Wound Ballistics.

The book can be used as a study text for ballistic courses, as it was written in a reader-friendly style and format. The authors explain the fundamental physics, theory and design techniques for each area of ballistics.

Martin Macko