

Modern Exterior Ballistics The Launch And Flight Dynamics Of Symmetric Projectiles

Training Circular (TC) 3-09.81, "Field Artillery Manual Cannon Gunnery," sets forth the doctrine pertaining to the employment of artillery fires. It explains all aspects of the manual cannon gunnery problem and presents a practical application of the science of ballistics. It includes step-by-step instructions for manually solving the gunnery problem which can be applied within the framework of decisive action or unified land operations. It is applicable to any Army personnel at the battalion or battery responsible to delivered field artillery fires. The principal audience for ATP 3-09.42 is all members of the Profession of Arms. This includes field artillery Soldiers and combined arms chain of command field and company grade officers, middle-grade and senior noncommissioned officers (NCO), and battalion and squadron command groups and staffs. This manual also provides guidance for division and corps leaders and staffs in training for and employment of the BCT in decisive action. This publication may also be used by other Army organizations to assist in their planning for support of battalions. This manual builds on the collective knowledge and experience gained through recent operations, numerous exercises, and the deliberate process of informed reasoning. It is rooted in time-tested principles and fundamentals, while accommodating new technologies and diverse threats to national security. This engaging and accessible book explains the scientific principles behind guns, both ancient and modern. It connects their evolution to advances in science, as well as tracing the developments of projectiles and propellants. It is not limited to small arms but also looks at the science of enormous guns such the Paris Gun, for example, and reviews the efforts to build a gun to launch projectiles into space. Extremely fast guns are also covered, such as two-stage guns and rail guns. Further, the book provides insight into the science of terminal ballistics and wound ballistics as well as the challenging subject of gun control. It is full of interesting facts for all who are curious about the science and history of guns, as well as those for whom the gun is an accessory of their profession. An essential preparation book for the ACSM Certified Exercise Physiologist examination, ACSM's Resources for the Exercise Physiologist, 3rd Edition, is an essential volume for certification candidates and practicing Exercise Physiologists looking to boost their exam confidence and achieve success in practice. This updated edition is fully aligned with the eleventh edition of ACSM's Guidelines for Exercise Testing and Prescription and reflects the most current standards and practices in exercise physiology. Published by the American College of Sports Medicine, this practical resource is organized around the scope of ACSM-EP practice domains. A clear introduction to understanding exercise, physical activity, and pre-exercise screening opens the book, followed by thorough coverage of assessment and programming for healthy populations, assessment and programming for special populations, counseling and behavioral

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strategies for encouraging exercises, and legal, management and professional issues relevant to practice.

This book contains the information needed to extract the best performance from your rifle. It is an up-to-date picture of what goes on in creating and shooting the ultimate in accurate rifles.

Published annually for more than eighty years, and with over seven million copies sold worldwide, Shooter's Bible is the most complete and sought-after reference guide for new products, specifications, and current prices on thousands of firearms and related equipment. The 103rd edition contains up-to-date handgun and rifle ballistic tables along with extensive charts of currently available bullets and projectiles for handloading, as well as a new products section. Complete with color and black and white photographs showcasing various makes and models of firearms and equipment, Shooter's Bible is the perfect addition to the bookshelf of any beginner or experienced hunter, firearm collector, or gun enthusiast.

Examines how terrorists make technology choices and how the United States can discourage terrorists' use of advanced conventional weapons. Concludes that the United States should urgently start discussions with key producer nations and also decide on an architecture needed to impose technical controls on new mortar systems that should enter development soon.

Includes papers that were first presented at a September 2011 conference organized by the National Defense Industrial Association and the International Ballistics Society. This title includes a CD-ROM that displays figures and illustrations in articles in full color along with a title screen and main menu screen.

This book makes available original ballistics technology from around the world on a wide variety of weapons and their effects, including the design and trajectory/stability control of dozens of projectiles ranging from shells to missiles. The book's authors discuss the efficacy and development of propellants, munitions, and igniters and offer new approaches for modeling and testing. Also investigated in Volume 1 is gradient printing of energetic materials, and mechanical behavior of multiple types of explosives. Volume 2 offers research on impact and penetration data from projectile effects on surfaces ranging from natural phenomena such as water, to metallic plating and material-engineered armors. Recent advances in reactive fragments, which provide enhanced terminal effects, are presented. Detailed analysis of warhead mechanisms such as the formation and terminal effects of shaped charge jets are reported. Papers in these volumes were presented at a conference jointly organized and supported by the Aeronautical Society of India, Hyderabad Branch, India, and the International Ballistics Society.

Presents high-level research on various caliber guns, cannon, mortars, drones, warheads, shells, bullets, drills and other launchers and penetrants, as well as their impact effects on natural and designed materials, including large-scale targets and body armors Provides new modeling and test data on projectile design and guidance, propellants, charges and explosives for military, aerospace and civil engineering applications Over 250 presentations in two printed volumes, plus searchable CD This book makes available original ballistics technology from around the world on a wide variety of weapons and their effects, including the design and trajectory/stability control of dozens of projectiles ranging from shells to missiles. The book's authors discuss the efficacy and development of propellants, munitions, and igniters and offer new approaches for modeling and testing. Also investigated in Volume 1 are shielding and

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protection strategies for individual persons and other targets. Volume 2 offers research on the mechanical behavior of multiple types of explosives, as well as impact and penetration data from projectile effects on surfaces ranging from natural phenomena such as water and soils to metallic plating and material-engineered armors. Papers in these volumes were presented at a conference organized by the National Defense Industrial Association (NDIA) with the International Ballistics Society.

Exterior Ballistics with Applications Skydiving, Parachute Fall, Flying Fragments presents a modern approach to introduce the basics of exterior ballistics and its methods from the simple ideal model of projectile motion to the automatic solution of the differential equations of projectile flight using PC programs. The book uses different approaches to solve the differential equations of projectile motion among them the Siacci method and the numerical methods. The results obtained through the integration of differential equations of projectile flight are mostly analytical formulas that describe the projectile trajectory and make the exterior ballistics a comprehensible science. The Differential Equations of Projectile Flight are also integrated numerically using some original PC programs that can be easily modified to be used in similar scenarios or other new ones and give the reader the possibility to solve a great variety of Exterior Ballistics problem. Exterior Ballistics with Applications can be considered as an interdisciplinary applied mathematics and physics manuscript for the vast mathematics and physics models and techniques employed. It is a great source for applications in physics, calculus, differential equations, numerical methods, and PC programming as well. The book is illustrated with about 140 solved examples related to different artillery and infantry firearms that demonstrate the use of formulas and the solution methods of ballistics to find the elements of projectile trajectories. Exterior Ballistics with Applications includes as well two interesting topics that can be considered as applications of exterior ballistics: 1. Skydiving and parachute falling related with the trajectory of a parachutist launched from a horizontally flying airplane with undeployed parachute, in different meteorological conditions, and in presence of air resistance and wind. 2. The ballistics of projectile fragments that is an important element of Terminal Ballistics necessary to study the effectiveness of fragmentation ammunitions on the personnel and objects, and other problems related with the construction of fragmentation ammunitions, or with Forensic Sciences. Exterior Ballistics with Applications is comprehensive and serves as reference material to provide answers to problems encountered in the practice of motion of unguided projectiles, skydiving and flying fragments of antipersonnel ammunitions. Ballistics and applied physics plays a very important role in the system design and development of rockets, missiles and weapon systems. This book is an outcome of a seminar on these topics

Containing the proceedings of the Third International Conference on Computational Ballistics, this book presents new ideas and advanced developments in the field of study of Computational Ballistics. Ballistic studies include applications as varied as the study of the structural and control behavior of rockets and communication satellites; bird strike effects on commercial aircraft, terrorist attacks and automobile crack worthiness modelling. Many basic problems of ballistics are similar to those in other fields of applications, such as combustion, heat conduction, in-flight structural behaviour, trajectory related issues, contact, impact, penetration, structural response to shock waves and many others. A valuable contribution to its field, this text will be of interest to researchers involved in the different areas of computational ballistics and their relationship between computational methods and experiments. Notable topics include: Systems and Technology; Combustion and Heat Transfer; Propellants; Fluid Dynamics; Fluid Flow and Aerodynamics; In-Flight Structural Behaviour and Material Response; Guidance and Control; Perforation and Penetration Mechanics; Fluid-structure Interaction; Experimental Mechanics/ballistic and Field Testing; High Rate Loads; Composite Material; Shock and Impact.

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Scores of talented and dedicated people serve the forensic science community, performing vitally important work. However, they are often constrained by lack of adequate resources, sound policies, and national support. It is clear that change and advancements, both systematic and scientific, are needed in a number of forensic science disciplines to ensure the reliability of work, establish enforceable standards, and promote best practices with consistent application. *Strengthening Forensic Science in the United States: A Path Forward* provides a detailed plan for addressing these needs and suggests the creation of a new government entity, the National Institute of Forensic Science, to establish and enforce standards within the forensic science community. The benefits of improving and regulating the forensic science disciplines are clear: assisting law enforcement officials, enhancing homeland security, and reducing the risk of wrongful conviction and exoneration. *Strengthening Forensic Science in the United States* gives a full account of what is needed to advance the forensic science disciplines, including upgrading of systems and organizational structures, better training, widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. While this book provides an essential call-to-action for congress and policy makers, it also serves as a vital tool for law enforcement agencies, criminal prosecutors and attorneys, and forensic science educators.

In this book, the author deals with the mathematical modelling, nonlinear control and performance evaluation of a conceptual anti-aircraft gun based mobile air defence system engaging an attacking three-dimensional aerial target. This book is of interest to academic faculty, graduate students and industry professionals working in the fields of mathematical modelling and control, ground vehicles, mobile air defence systems and other related topics. A brand-new edition of the classic guide on low-speed wind tunnel testing While great advances in theoretical and computational methods have been made in recent years, low-speed wind tunnel testing remains essential for obtaining the full range of data needed to guide detailed design decisions for many practical engineering problems. This long-awaited Third Edition of William H. Rae, Jr.'s landmark reference brings together essential information on all aspects of low-speed wind tunnel design, analysis, testing, and instrumentation in one easy-to-use resource. Written by authors who are among the most respected wind tunnel engineers in the world, this edition has been updated to address current topics and applications, and includes coverage of digital electronics, new instrumentation, video and photographic methods, pressure-sensitive paint, and liquid crystal-based measurement methods. The book is organized for quick access to topics of interest, and examines basic test techniques and objectives of modeling and testing aircraft designs in low-speed wind tunnels, as well as applications to fluid motion analysis, automobiles, marine vessels, buildings, bridges, and other structures subject to wind loading. Supplemented with real-world examples throughout, *Low-Speed Wind Tunnel Testing, Third Edition* is an indispensable resource for aerospace engineering students and professionals, engineers and researchers in the automotive industries, wind tunnel designers, architects, and others who need to get the most from low-speed wind tunnel technology and experiments in their work.

The science of small arms ballistics is seriously underdeveloped and underappreciated. This unique and different book is a comprehensive study that fills a legitimate need for a work that covers the engineering and theory of small

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arms ballistics. The author shares his extensive research on working out the science of small arm ballistics mathematically and explains his theories, such as the field-effect and the field-effect over trajectory and time, along with new theories on interior, exterior, and terminal ballistics. Each equation describes a mathematical relationship, such as transfer of energy, and has an engineering application to help solve a design problem. Some equations, such as the calculation of bullet length with a given muzzle velocity and rate of twist, represent manipulations of those equations. Some other equations represent a set of mathematical instructions to resolve a technical problem, such as the computation of trajectory or depth of penetration of living tissue in real-time. The field of fluid mechanics is vast and has numerous and diverse applications. Presented papers from the 11th International Conference on Advances in Fluid Dynamics with emphasis on Multiphase and Complex Flow are contained in this book and cover a wide range of topics, including basic formulations and their computer modelling as well as the relationship between experimental and analytical results. Innovation in fluid-structure approaches including emerging applications as energy harvesting systems, studies of turbulent flows at high Reynold number, or subsonic and hypersonic flows are also among the topics covered. The emphasis placed on multiphase flow in the included research works is due to the fact that fluid dynamics processes in nature are predominantly multiphased, i.e. involving more than one phase of a component such as liquid, gas or plasma. The range of related problems of interest is vast: astrophysics, biology, geophysics, atmospheric processes, and a large variety of engineering applications. Multiphase fluid dynamics are generating a great deal of interest, leading to many notable advances in experimental, analytical, and numerical studies in this area. While progress is continuing in all three categories, advances in numerical solutions are likely the most conspicuous, owing to the continuing improvements in computer power and the software tools available to researchers. Progress in numerical methods has not only allowed for the solution of many practical problems but also helped to improve our understanding of the physics involved. Many unresolved issues are inherent in the very definition of multiphase flow, where it is necessary to consider coupled processes on multiple scales, as well as the interplay of a wide variety of relevant physical phenomena.

1. A new science / 2. A hypersonic research airplane / 3. Conflict and innovation / 4. The million-horsepower engine / 5. High range and dry lakes / 6. Preparations / 7. The flight program / 8. The research program.

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This is a short, focused introduction to MATLAB, a comprehensive software system for mathematical and technical computing. It contains concise explanations of essential MATLAB commands, as well as easily understood instructions for using MATLAB's programming features, graphical capabilities, simulation models, and rich desktop interface. Written for MATLAB 7, it can also

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be used with earlier (and later) versions of MATLAB. This book teaches how to graph functions, solve equations, manipulate images, and much more. It contains explicit instructions for using MATLAB's companion software, Simulink, which allows graphical models to be built for dynamical systems. MATLAB's new "publish" feature is discussed, which allows mathematical computations to be combined with text and graphics, to produce polished, integrated, interactive documents. For the beginner it explains everything needed to start using MATLAB, while experienced users making the switch to MATLAB 7 from an earlier version will also find much useful information here.

The definitive interdisciplinary reference work for wound ballistics Fundamentals in Physics, arms and ammunition, ballistics Simulating gunshot wounds: Virtopsy – a virtual autopsy method, combining CT, MRT and surface scanning and Materials that reproduce the interaction of soft tissue, bone and blood vessels with a bullet that penetrates the body. Wound ballistics for Short-range and long-range weapons, fragments, such as those from bombs and hand grenades, gas jets from blanks, gas weapons, etc., “Non-lethal” weapons as used by the police, in military operations or in urban settings Specialist knowledge and reference detailed tables: ballistic tables for typical ammunition, ballistic values for numerous types of ammunition, including older types, materials properties, plus additional, hard-to-find data. Most tables are in both metric and U.S. units., an extensive trilingual glossary of specialized terminology in German, English and French NEW: the latest diagnostic / simulation methods and the latest types of ammunition The practice and application of wound ballistics in: forensic medicine, surgery – especially emergency and war surgery and international conventions Globalized conflict zones, terrorism and crime – these issues affect a wider circle than just the armed forces and medical services abroad. Police officers, surgeons, forensics specialists and criminalists also need to be familiar with ballistics and gunshot wounds and must be able to assess the complex factors involved. The practice and application of wound ballistics in forensic medicine. surgery – especially emergency and war surgery and International conventions. Globalized conflict zones, terrorism and crime – these issues affect a wider circle than just the armed forces and medical services abroad. Police officers, surgeons, forensics specialists and criminalists also need to be familiar with ballistics and gunshot wounds and must be able to assess the complex factors involved.

Even the earliest weapon developers faced the need to understand how and why guns and ammunition work in order to improve their effectiveness. As weapons became more sophisticated, the field of ballistics naturally divided into three main areas of specialization: interior, exterior, and terminal ballistics. Providing unique coverage of all three ar This book features most of the papers presented at the International Conference on Computational Ballistics 2005. The contents stress the importance and possibilities of numerical simulation on internal, external and terminal ballistics, to describe, analyse, predict and subsequently reduce the experimental requirements in ballistics.

Ballistics deals with the mechanics of projectiles. A primary aspect of study under this field are

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bullets. It delves into the launch, effects and behavior of bullets. The designing of projectiles is also a significant aspect of this subject. Ballistics has four sub-fields namely terminal ballistics, internal ballistics, transitional ballistics, and external ballistics. This book attempts to understand the multiple branches that fall under the discipline of ballistics and how such concepts have practical applications. It elucidates the modern aspects and innovative models around prospective developments with respect to ballistics. This textbook is meant for students who are looking for an elaborate reference text on ballistics.

Providing new chapters, homework problems, case studies, figures, and examples, *Ballistics: Theory and Design of Guns and Ammunition, Second Edition* encourages superior design and innovative applications in the field of ballistics. It examines the analytical and computational tools used to predict a weapon's behavior in terms of pressure, stress, and velocity, demonstrating their applications in ammunition and weapons design. What's New in the Second Edition: Includes computer examples in Mathcad (available on the CRC website) Adds a section of color plates, to better help readers visualize the physical concepts of ballistics Contains sections on modern explosives equations of state for detonation physics modeling and on probability of hit Provides a solutions manual for those teaching college and training courses This book covers exterior ballistics, exploring the physics behind trajectories, including linear and nonlinear aeroballistics, and focuses on the effects of projective impact, including details on shock physics, shaped charges, penetration, fragmentation, and wound ballistics. Reviews and integrates the fundamental science and engineering concepts involved in guns and ammunition Uses straightforward, easy-to-read style, and careful development of complex topics Shares insights rooted in the experience of renowned experts, many associated with the National Defense Industrial Association (NDIA) and International Ballistics Society The field of ballistics comprises three main areas of specialization: interior, exterior, and terminal ballistics. This book explains all three areas, offering a seamless presentation of the complex phenomena that occur during the launch, flight, and impact of a projectile.

The U.S. Army fought World War II with materiel much of which was developed in the decade prior to our entry, particularly in the period following the German blitz in Poland. Our efforts to develop munitions to the point where our armies could cope on equal terms with those of potential enemies are covered here in this, the first of three projected volumes on the history of the Ordnance Department in World War II. How well the Ordnance Department succeeded in matching the Germans in quality continues to be a matter of debate both within the Ordnance Department itself, and between the using arms and the Department. That the battle of quantity was won-with the help of a superb industrial machine-can hardly be denied. This volume, the result of diligent research by Dr. Constance McL. Green and her associates, should interest not only military men but also scientists, industrialists, and laymen in general. Among other things, it shows the urgent necessity of a directed, continuous, and intensive research program and the danger in failing to recognize and profit by developments abroad. Also shown is the inherent time interval between the drawing board and the production of the end item in quantity."

The book presents the papers presented at the 6th international conference on Explosion, Shock Wave and High Strain-Rate Phenomena (ESHP). Topics covered include: Advanced Manufacturing under Impact/Shock Loading, Detonation of High Pressure Flammable Gas in Closed Spaces, High Strain-Rate Behaviour of Auxetic Cellular Structures, Underwater Shock Waves Generation, Magnetic Pressure Welding of Aluminum Sheets, Shock Synthesis of Zirconium Oxides, Impact Joining of Dissimilar Metals, High-Speed Oblique Collision of Metals, Dynamic Behavior of Dislocation Wall Structures, Tensile Strength of Rock at High Strain Rates, Fiber Reinforced Mortar, Impact Analysis of Carbon Fiber Reinforced Polymer, Explosive Welding , Underwater Explosive Welding , Making Ultrafine Explosives, Aluminum-Steel Explosive Cladding, Explosively Cladded Aluminum Hybrid Composites, Explosive Clads

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with Interlayers.

Modern Exterior Ballistics is a comprehensive text covering the basic free flight dynamics of symmetric projectiles. The book provides a historical perspective of early developments in the 19th century, the technology leading to World War I and that through World War II into the modern post-war era. Historical topics include the first ballistic firing tables, early wind tunnel experiments, the development of free flight spark ranges and the first supercomputer, ENIAC, which was designed to compute artillery trajectories for the U.S. Army Ballistic Research Laboratory. The level of the text requires an undergraduate education in mathematics, physics, and mechanical or aerospace engineering. The basic principles of ballistic science are developed from a comprehensive definition of the aerodynamic forces that control the flight dynamics of symmetric projectiles. The author carefully starts with the basic vacuum point mass trajectory, adds the effects of drag, discusses the action of winds, simple flat fire approximations, Coriolis effects and concludes with the classic modified point mass trajectories. Included in the discussion are analytical methods, change of variables from time to distance, numerical solutions and a chapter on the Siacci Method. The Siacci Method provides a historical perspective for computing flat fire trajectories by simple quadrature and is used in the sporting arms industry. The final six chapters of the book present an extensive physical and mathematical analysis of the motion of symmetric projectiles. The linearized equations of angular and swerving motion are derived in detail. The effects of mass asymmetry, in-bore yaw, cross wind and launch in a slipstream are discussed. Special consideration is given to the derivation and explanation of aerodynamic jump. These subjects are then expanded to include a complete chapter on nonlinear aerodynamic forces and moments. The final chapter in the book presents an overview of experimental methods for measuring the flight dynamics of projectiles. The great forte of Modern Exterior Ballistics is the author's effort to provide many fine specific examples of projectile motion illustrating key flight behaviors. The extensive collection of data on projectiles from small arms to artillery used to substantiate calculations and examples is alone a valuable reference. The ultimate joy of the book is the incomparable comprehensive set of flow field shadow graphs illustrating the entire spectrum of projectile flight from subsonic, through transonic and supersonic. The volume is a necessary addition to any undergraduate or graduate course in flight dynamics.

With new chapters, homework problems, case studies, figures, and examples, Ballistics: Theory and Design of Guns and Ammunition, Third Edition encourages superior design and innovative applications in the field of ballistics. It examines the analytical and computational tools for predicting a weapon's behavior in terms of pressure, stress, and velocity, demonstrating their applications in ammunition and weapons design. New coverage in the Third Edition includes gas-powered guns, and naval ordinance. With its thorough coverage of interior, exterior and terminal ballistics, this new edition continues to be the standard resource for those studying the technology of guns and ammunition.

Shooting Incident Reconstruction, Third Edition, offers a thorough explanation of matters from simple to complex to help the reader understand the factors surrounding ballistics, trajectory, and shooting scenes. Forensic scientists, law enforcement, and crime scene investigators are often tasked with reconstruction of events based on crime scene evidence, along with the subsequent analysis of that evidence. The use and misuse of firearms to perpetrate crimes from theft to murder necessitates numerous invitations to reconstruct shooting incidents. The discharge of firearms and the behavior of projectiles create many forms of physical evidence that, through proper testing and interpretation by a skilled forensic scientist, can establish what did and what did not occur. Written by the world's most well-respected shooting scene and ballistics experts, the book addresses the terminology, science, and factors involved in reconstructing shooting incident events to solve forensic cases. It covers the full range of related topics including: the range from which a firearm was discharged; the sequence of shots

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in a multiple discharge shooting incident; the position of a firearm at the moment of discharge; and the position of a victim at the moment of impact. The probable flight path of a projectile and the manner in which a firearm was discharged are also discussed. Case studies illustrate real-world application of technical concepts, supported by over 200 full-color diagrams and photographs. This book will be of value to practicing forensic scientists (firearm and toolmark examiners), ballistics experts, crime scene personnel, police departments, forensic consultants (generalists), attorneys and judges, medical examiners (coroners), and forensic pathologists. New chapters on special reconstructive properties and value of shootings involving sub-machine guns or pseudo automatic firearms, rate of fire with special attention on shot-to-shot time intervals, human factors in shooting incidents Updated and revised glossary terms to fit with new technology and the emergence of standardization of terms by groups such as the Organization of Scientific Advisory Committees Provides clear practice standards and ethical guidelines for those involved in reconstructing shooting scenes

Ordinary folks can construct 13 awesome ballistic devices in their garage or basement workshops using inexpensive household or hardware store materials and this step-by-step guide. Clear instructions, diagrams, and photographs show how to build projects ranging from the simple—a match-powered rocket—to the more complex—a scale-model, table-top catapult—to the offbeat—a tennis ball cannon. With a strong emphasis on safety, the book also gives tips on troubleshooting, explains the physics behind the projects, and profiles scientists and extraordinary experimenters such as Alfred Nobel, Robert Goddard, and Isaac Newton. This book will be indispensable for the legions of backyard toy-rocket launchers and fireworks fanatics who wish every day was the fourth of July.

Exterior Ballistics: A New Approach presents the exterior ballistics of point-mass projectiles based on the analytical G-drag functions (G1, G2, ... G7, G8, Siacci's G-function, etc.) and on the "projectile trajectory-streamline and Snell's law" model that is a fundamental result obtained by applying, to the flight of projectiles, the postulate of Sir Isaac Newton on the wave nature of moving bodies and his interpretation of the Snell's law on refraction of waves. The impressive outcomes obtained solving exterior ballistics problems employing Snell's law demonstrate that the flight of objects can be quantitatively described using wave properties of particles. The WONDERS of Using Snell's Law in Exterior Ballistics Exterior Ballistics: A New Approach is a unique book in the literature of exterior ballistics for the original methods introduced to solve the exterior ballistics problems and particularly for the use of Snell's law in exterior ballistics. Backed with in-depth discussions based on comprehensive research and study, Exterior Ballistics: A New Approach provides original solutions in solving exterior ballistics problems especially employing the "projectile trajectory-streamline and Snell's law" model. The use of Snell's law simplifies the ballistics calculations reducing them to simple mathematics operations. Exterior Ballistics: A New Approach is an excellent reference book that provides answers to problems encountered in the practice of motion of unguided projectiles fired by artillery and small arms. The book has around 80 solved exterior ballistics problems that illustrate the theoretical topics, guide and help the reader to solve similar and new ballistics problems. There are included four compact types of original universal PC programs that enable the reader to solve any exterior ballistics problem as well as the ballistics problems related with fire control of unguided projectiles. Exterior Ballistics: A New Approach is an informative book highly recommended to students, professors, and novice, military students and faculty, as well as to experienced ballisticians.

It is summer and the Canadian Rockies are on fire. As the forests blaze, Alan West heads into their shadows, returning from university to his grandfather's home in the remote Kootenay Valley, where the man who raised him has suffered a heart attack. Confronting his own mortality, the tough and taciturn Cecil West has a dying request for his grandson: track down the father Alan has never known so that the old man can make peace with him. And so Alan

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begins his search for the elusive Jack West, a man who skipped town before his son could walk and of whom his grandfather has always refused to speak. His quest will lead him to Archer, an old American soldier who decades ago went AWOL across the border into Canada. Archer has been carrying a heavy burden for many years, and through him Alan learns the stories of two broken families who came together, got too close, and then fell apart in tragic ways. Ballistics is a remarkable first novel, about family ties and the wounds that can linger for generations when those relationships are betrayed.

TRANSFER MATRIX METHOD FOR MULTIBODY SYSTEMS: THEORY AND APPLICATIONS Xiaoting Rui, Guoping Wang and Jianshu Zhang - Nanjing University of Science and Technology, China Featuring a new method of multibody system dynamics, this book introduces the transfer matrix method systematically for the first time. First developed by the lead author and his research team, this method has found numerous engineering and technological applications. Readers are first introduced to fundamental concepts like the body dynamics equation, augmented operator and augmented eigenvector before going in depth into precision analysis and computations of eigenvalue problems as well as dynamic responses. The book also covers a combination of mixed methods and practical applications in multiple rocket launch systems, self-propelled artillery as well as launch dynamics of on-ship weaponry. • Comprehensively introduces a new method of analyzing multibody dynamics for engineers • Provides a logical development of the transfer matrix method as applied to the dynamics of multibody systems that consist of interconnected bodies • Features varied applications in weaponry, aeronautics, astronautics, vehicles and robotics Written by an internationally renowned author and research team with many years' experience in multibody systems Transfer Matrix Method of Multibody System and Its Applications is an advanced level text for researchers and engineers in mechanical system dynamics. It is a comprehensive reference for advanced students and researchers in the related fields of aerospace, vehicle, robotics and weaponry engineering.

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