Design Basics Of Solid Propellant Rockets

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Solid Propellant Rocket Research Martin Summerfield 2013-11-11 Solid Propellant Rocket Research

DESPOT. A Computer Scheme Optimizing the Propulsion Design And/or Trajectory of a Solid Propellant Rocket Lawrence A. Feldman 1974 This technical report presents a complete user manual describing DESPOT (DESign Performance OpTimization), a FORTRAN IV computer program with capabilities extending to: (1) preliminary evaluations of solid rocket propulsion units; (2) two-dimensional round earth trajectory analysis; and (3) parametric trade-offs on the computed design and/or trajectory by the Variation-of-Parameters Optimization Techniques. In addition, the program can provide the necessary sybsystem constraining data that are prerequisite to the design of the warhead and the guidance missile subsystems. The rocket design computational algorithms interrlate 21 propulsion subsystem parameters: seven of which are input and the remaining 14 calculated. Restricitons imposed on the selection of input parameter combinations prevent over-definition of the missile system. There are five guidance maneuvers, five termination options, and 16 parameter contraints that may be imposed on the trajectory. Liquid rockets can be accommodated by the trajectory routine. The optimization technique can treat 28 rocket design parameters and seven trajectory parameters. The optimum criteria consists of maximum or minimum flight time, range, velocity, flightpath angle, and altitude. The design, trajectory, and optimization routines can be executed individually or in combination, forming an iterative scheme relating design criteria with performance evaluation. Extent of output varies from a cursory description of results to more elaborate digital plots of trajectory and optimization calculations. Instructions for data entry, execution, and redefinition of computational logic are contained in this report.

Considerations for Designers of Cases for Small Solid Propellant Rocket Motors H. Badham 1988 When considering the initial design of the case or load bearing components for a solid propellant rocket motor a number of possible solutions may be apparent and many factors need consideration before the design of the individual components can be finalised. The process of optimisation involves consideration of material properties, methods of manufacture, inspection and proof as well as interactions with other rocket motor and missile components. The various factors are considered and indications are given of the interactions to be taken into account. This paper concentrates primarily on the design of metallic motor cases. Both homogeneous and nonhomogeneous body structures are considered, the latter being fibre overwound metallic and strip laminates. A relatively recent requirements is that for insensitive munitions and this factor is also discussed relative to body construction.

Rocket Propulsion Elements George P. Sutton 2010-02-02 The definitive text on rocket propulsion—now revised to reflect advancements in the field For sixty years, Sutton's Rocket Propulsion Elements has

been regarded as the single most authoritative sourcebook on rocket propulsion technology. As with the previous edition, coauthored with Oscar Biblarz, the Eighth Edition of Rocket Propulsion Elements offers a thorough introduction to basic principles of rocket propulsion for guided missiles, space flight, or satellite flight. It describes the physical mechanisms and designs for various types of rockets' and provides an understanding of how rocket propulsion is applied to flying vehicles. Updated and strengthened throughout, the Eighth Edition explores: The fundamentals of rocket propulsion, its essential technologies, and its key design rationale The various types of rocket propulsion systems, physical phenomena, and essential relationships The latest advances in the field such as changes in materials, systems design, propellants, applications, and manufacturing technologies, with a separate new chapter devoted to turbopumps Liquid propellant rocket engines and solid propellant rocket motors, the two most prevalent of the rocket propulsion systems, with in-depth consideration of advances in hybrid rockets and electrical space propulsion Comprehensive and coherently organized, this seminal text guides readers evenhandedly through the complex factors that shape rocket propulsion, with both theory and practical design considerations. Professional engineers in the aerospace and defense industries as well as students in mechanical and aerospace engineering will find this updated classic indispensable for its scope of coverage and utility.

Thermodynamic and Ballistic Design Fundamentals of Solid-Propellant Rocket Engines (Selected Chapters). B. V. Orlov 1970 The book gives an account of thermodynamic principles of the calculation of solid-propellant rocket engines, engineering methods of the calculation of processes of heat exchange, principles of the theory of the combustion of solid propellants and the calculation of the indicating pressure curve in the combustion chamber of an engine. Basic information is given concerning solid rocket propellants and heat-proof coverings used in solid-propellant rocket engines. Thrust control in these rocket engines with respect to magnitude and direction and also the general method of ballistic design of solid-propellant rockets are discussed. The solution of simplified problems of interior ballistics of classical artillery and recoilless weapons is covered, and a solution is given for three expressions of the law of the combustion of the solid propellant. (Author).

Thermodynamic and Ballistic Design Fundamentals of Solid-propellant Rocket Engines Boris Viktorovich Orlov 1966 In this book, on the basis of materials published in the Soviet and foreign press, there are expounded thermo-gas-dynamic principles of designing of rocket engines, engineering methods of calculation of processes of heat exchange, principles of the theory of burning of solid fuels and calculation of the indicated pressure curve in the combustion chamber of the engine. In it there is given basic information about solid rocket propellants applied in solid-propellant rocket engines (SPRE). There is considered regulation of thrust in SPRE in magnitude and direction, and also a general method of ballistic designing of solid-fuel rockets. (Author).

Rocket Propulsion Elements George Paul Sutton 1986 A revision of the standard text on the basic technology, performance and design rationale of rocket propulsion. After discussing fundamentals, such as nozzle thermodynamics, heat transfer, flight performance and chemical reaction analysis, the book continues with treatments of various types of liquid and solid propellants and rocket testing. It brings together the engineering science disciplines necessary for rocket design: thermodynamics, heat transfer, flight mechanics, chemical reactions and materials behavior. SI units and information on computer-aided testing have also been added.

Solid Propellant Rocket Motor Design Armando D. Pires 1990

The Design of Solid Propellant Rocket Motors Ministry of Supply 1955

Solid Propellant Grain Structural Integrity Analysis United States. National Aeronautics and Space Administration 1973

Fundamentals of Rocket Propulsion DP Mishra 2017-07-20 The book follows a unified approach to present the basic principles of rocket propulsion in concise and lucid form. This textbook comprises of ten chapters ranging from brief introduction and elements of rocket propulsion, aerothermodynamics to solid, liquid and hybrid propellant rocket engines with chapter on electrical propulsion. Worked out examples are also provided at the end of chapter for understanding uncertainty analysis. This book is designed and developed as an introductory text on the fundamental aspects of rocket propulsion for both undergraduate and graduate students. It is also aimed towards practicing engineers in the field of space engineering. This comprehensive guide also provides adequate problems for audience to understand intricate aspects of rocket propulsion enabling them to design and develop rocket engines for peaceful purposes.

Design and Evaluation of a Turbojet-exhaust Simulator with a Solid-propellant Rocket Motor for Free-flight Research Abraham Leiss 1957

Thermodynamic and Ballistic Principles for the Design of Solid-propellant Rocket Engines (selected Chapters). B. V. Orlov 1970 This book, on the basis of materials published in the domestic and foreign press, presents the thermogasodynamics principles of the design of engines, the engineering methods of calculating heat exchange processes, the principles of solid propellant combustion, and the calculation of the indicator curve of pressure in the engine combustion chamber. The book gives basic information on solid propellants used in solid rocket engines. Thrust regulation in solid rocket engines and the ballistic principles of solid rocket engines are examined. The book is intended for students in higher technical education institutes and for engineers-technicians specializing in solid fuel rocket engines. (Author).

Systematic Design of Charges for Solid Propellant Rocket Motors H. M. Darwell 1959

Mechanics and Chemistry of Solid Propellants 1967

Optimum Design of Solid Propellant Rockets JEAN A. VANDENKERCKHOVE 1960 A method is proposed whereby one can study rapidly the weight and size variations of a rocket motor that has to conform to given specifications in the full range of usable geometries and pressures. The method is general and independent of the shape of the propulsive charge, although it takes into account the ballistic properties of the propellant. Thus, from the preliminary design stage, the characteristics of the optimum motor can be determined. Also it is possible, when necessary, to make an estimate of how far one departs from the optimum to satisfy an extra condition. Finally it stresses the advantage that seems to exist in using several motors instead of a single unit in the case of large thrusts and short burning times. The acceleration of a rocket up to a given speed is also studied and relations have been established giving the maximum velocity obtainable when the outer diameter of the motor is imposed. Finally the importance of the dead weight is underlined.

Design and Evaluation of a Turbojet Exhaust Simulator, Utilizing a Solid-Propellant Rocket Motor, for Use in Free-Flight Aerodynamic Research Models Carlos A. Demoraes 2013-07 A method has been developed for modifying a rocket motor so that its exhaust characteristics simulate those of a turbojet engine. The analysis necessary to the design is presented along with tests from

which the designs are evaluated. Simulation was found to be best if the exhaust characteristics to be duplicated were those of a turbojet engine at high altitudes and with the afterburner operative.

Design Considerations in Selecting Materials for Large Solid-propellant Rocket-motor Cases Charles Wesley Bert 1962

Modern Engineering for Design of Liquid-Propellant Rocket Engines Dieter K. Huzel 1992

State of the Art of Solid Propellant Rocket Motor Grain Design in the United States Durwood I. Thrasher 1988 This paper begins with a brief discussion of the basic ground rules and overall considerations in solid rocket motor design. This discussion includes ballistic design considerations, grain features related to ballistic design and their purposes, primary factors which determine stress and strain levels, and design approaches for avoiding structural weak points. The major section of the paper deals with solid rocket motor propellant grain structural integrity assurance, including materials characterization, structural analysis, and structural capability verification. The topics addressed include viscoelastic material behavior and the requisite thermomechanical characterization testing and analysis approaches; failure criteria and the appropriate testing approaches; experimental structural methods, including in-situ stress and strain measurement technology; and service life considerations.

FUNDAMENTALS OF DESIGN FOR SOLID-PROPELLANT ROCKET MISSILES. 1962

The Design of a Miniature Solid-propellant Rocket Robert H. Heitkotter 1956 A miniature rocket motor was designed and developed to produce 3 ounces of thrust for a duration of 2 seconds.The rocket is simply designed, safe to operate, easily handled, and gives reproducible performance. Standard solid-propellant-rocket design techniques were found to be not wholly applicable to the design of miniature rockets because of excessive heat loss.

Fundamental Concepts of Liquid-Propellant Rocket Engines Alessandro de Iaco Veris 2020-09-26 This book is intended for students and engineers who design and develop liquid-propellant rocket engines, offering them a guide to the theory and practice alike. It first presents the fundamental concepts (the generation of thrust, the gas flow through the combustion chamber and the nozzle, the liquid propellants used, and the combustion process) and then qualitatively and quantitatively describes the principal components involved (the combustion chamber, nozzle, feed systems, control systems, valves, propellant tanks, and interconnecting elements). The book includes extensive data on existing engines, typical values for design parameters, and worked-out examples of how the concepts discussed can be applied, helping readers integrate them in their own work. Detailed bibliographical references (including books, articles, and items from the “gray literature”) are provided at the end of each chapter, together with information on valuable resources that can be found online. Given its scope, the book will be of particular interest to undergraduate and graduate students of aerospace engineering.

Combustion Instability and the Design of Solid Propellant Rocket Motors A. K. Roberts 1970 The design of a solid propellant rocket motor is generally constrained to meet specific ballistic requirements which are, in turn, imposed by vehicle trajectory considerations. Since the abnormalities associated with combustion instability are characterized by rapid and often severe fluctuations of motor pressure and thrust, unstable operation cannot usually be tolerated in flight vehicles. Consequently, care must be taken during the development phase to design towards stable operation and to dynamically test prototype motors. The nonlinear longitudinal mode of combustion instability is often encountered in motors containing aluminized propellants and has had an important influence on a number of Canadian

development programs. The present paper is based on extensive experimental studies of this phenomenon carried out at the Defence Research Establishment Valcartier. This work has yielded a good phenomenological description of the instability, design criteria and guidelines and evaluation techniques which can be of considerable utility to the motor designer. These are described with the aid of typical data. (Author).

Solid Propellant Rocket Motor Design and Testing Richard Allan Nakka 1984

A Study of Erosive Burning and Optimum Design of Solid Propellant Rocket Motors Robert George Sampson 1960

Solid Propellant Rockets Clayton Huggett 2015-12-08 Part of the Princeton Aeronautical Paperback series designed to bring to students and research engineers outstanding portions of the twelve-volume High Speed Aerodynamics and Jet Propulsion series. These books have been prepared by direct reproduction of the text from the original series and no attempt has been made to provide introductory material or to eliminate cross reference to other portions of the original volumes. Originally published in 1960. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

The Man-computer Link in Solid-propellant Rocket Preliminary Design and Optimization D. P. Dudley 1968

Liquid Rocket and Propellants L.E. Bollinger 1960 Liquid Rocket and Propellants

Solid Propellant Processing Factors in Rocket Motor Design Carlton L. Horine 1971

Some Factors which Affect the Design of Solid Propellant Rocket Engines Hubert Skembare 1959

Design of Solid Fuel for Rockets Himanshu Shekhar 2019-12-11 Rocket Science is illustrated for Kids and pre-teens, in this book. Design of simple solid propellant configurations is explained in the book, which can generate interest and keep younger generation explore more and be ready for the propellant design for their own future missions. All calculations can be made with simple calculator and basic principles of physics along with special terminologies of Rocket Science are introduced. The book can make many more Rocket Scientists. The main theme of the book is "It is Rocket Science and even kids understand it".

Manuals Combined: Early Solid Propellant Rocket Technology Studies 1. Altitude Starting Tests of a 1000-Pound-Thrust Solid-Propellant Rocket Document ID: 20050019243 Author: Sloop, John L.; Rollbuhler, R. James; Krawczonek, Eugene M. Abstract: Four solid-propellant rocket engines of nominal 1000-pound-thrust were tested for starting hide Publication Year: 1957 Document Type: Technical Report Report/Patent Number: NACA-RM-E57G29 Date Acquired: Jan 11, 2005 2. Analytical and experimental studies of spherical solid-propellant rocket motors Document ID: 19930089785 Author: Thibodaux, Joseph G , Jr; Swain, Robert L; Wright, George Abstract: No Abstract Available Publication Year: 1957 Report/Patent Number: NACA-RM-L57G12a Date Acquired: Sep 01, 1996 3. Design and

evaluation of a turbojet-exhaust simulator with a solid-propellant rocket motor for free-flight research Document ID: 19930089701 Author: Leiss, Abraham Abstract: No Abstract Available Publication Year: 1957 Report/Patent Number: NACA-RM-L57E10a Date Acquired: Sep 01, 1996 4. Flight Performance of a 2.8 KS 8100 Cajun Solid-propellant Rocket Motor Document ID: 19930089581 Author: Lee, Dorothy B Abstract: No Abstract Available Publication Year: 1957 Report/Patent Number: NACA-RM-L56K01 Date Acquired: Sep 01, 1996 5. Flight Investigation of the Performance of a Two-stage Solid-propellant Nike-deacon (DAN) Meteorological Sounding Rocket Document ID: 19930084525 Author: Heitkotter, Robert H Abstract: A flight investigation of two Nike-Deacon (DAN) two-stage solid-propellant rocket vehicles indicated hide Publication Year: 1956 Report/Patent Number: NACA-TN-3739 Date Acquired: Sep 01, 1996 6. The Design of a Miniature Solid-propellant Rocket Document ID: 19930084361 Author: Heitkotter, Robert H Abstract: No Abstract Available Publication Year: 1956 Report/Patent Number: NACA-TN-3620 Date Acquired: Sep 01, 1996 7. Design and Evaluation of a Turbojet Exhaust Simulator, Utilizing a Solid-Propellant Rocket Motor, for use in Free-Flight Aerodynamic Research Models Document ID: 20050019463 Author: deMoraes, Carlos A.; Hagginbothom, William K., Jr.; Falanga, Ralph A. Abstract: A method has been developed for modifying a rocket motor so that its exhaust characteristics hide Publication Year: 1954 Document Type: Technical Report Report/Patent Number: NACA-RM-L54I15 Date Acquired: Jan 14, 2005 8. Some measurements of noise from three solid-fuel rocket engines Document ID: 19930084074 Author: Lassiter, Leslie W; Heikotter, Robert H Abstract: No Abstract Available Publication Year: 1954 Report/Patent Number: NACA-TN-3316 Date Acquired: Sep 01, 1996 9. Investigation of Vanes Immersed in the Jet of a Solid-fuel Rocket Motor Document ID: 19930087161 Author: Giladett, Leo V; Wineman, Andrew R Abstract: No Abstract Available Publication Year: 1952 Report/Patent Number: NACA-RM-L52F12 Date Acquired: Sep 01, 1996 10. An experimental investigation of the effect of high-pressure tailpipe length on the performance of solid-propellant motors for rocket-powered aircraft Document ID: 19930087092 Author: Rodriguez, Charles J Abstract: No Abstract Available Publication Year: 1952 Report/Patent Number: NACA-RM-L52E12a Date Acquired: Sep 01, 1996

Performance and Some Design Aspects of the Four-stage Solid-propellant Rocket Vehicle Used in the RAM A1 Flight Test Jack Levine 1963 A general description, some details of mechanical design and construction, and performance (including angle of attack of the rolling last stage) of a four-stage solid-propellant rocket system used in the RAM (Radio Attenuation Measurement) Al flight test are presented. The fourth stage attained a maximum velocity of 17,800 feet per second at an altitude of 175,000 feet. Temperature data on the nose cone are also discussed.

Solid-Propellant Rocket Engines A. M. Vinitskii 1974 The book describes the motion of combustion products in the chamber and nozzle of solid-propellant rocket engine. The spreads of intrachamber and output characteristics of RDTT, caused by random and systematic deviations of the loading parameters are analyzed. The effect of the engine and propellant characteristics on the ideal velocity of the rocket is also analyzed. The book also examines the procedure for profiling of nozzles, the motion of two-phase combustion products, and the calculation and design of charges from solid rocket propellants.

An Interactive Computer Code for Preliminary Design of Solid Propellant Rocket Motors Chung-I. Yuan 1987 An interactive computer code for the preliminary design of solid propellant rocket motors ('SPRMD') was successfully developed and its use was demonstrated through a design example. 'SPRMD' was written in FORTRAN for use on an IBM PC/AT. It combined several existing codes ('MICROPEP', 'GRAINS', 'ROCKET', etc.) and used the performance loss estimation methods suggested by the AGARD Propulsion and Energetics Panel for aluminized propellants. Keywords: Solid propellant rocket motor, Design.

Chemical Rockets Subramaniam Krishnan 2019-10-10 The purpose of this book is to discuss, at the graduate level, the methods of performance prediction for chemical rocket propulsion. A pedagogical presentation of such methods has been unavailable thus far and this text, based upon lectures, fills this gap. The first part contains the energy-minimization to calculate the propellant-combustion composition and the subsequent computation of rocket performance. While incremental analysis is for high performance solid motors, equilibrium-pressure analysis is for low performance ones. Both are detailed in the book's second part for the prediction of ignition and tail-off transients, and equilibrium operation. Computer codes, adopting the incremental analysis along with erosive burning effect, are included. The material is encouraged to be used and presented at lectures. Senior undergraduate and graduate students in universities, as well as practicing engineers and scientists in rocket industries, form the readership.

Solid Rocket Propulsion Technology A. Davenas 2012-12-02 This book, a translation of the French title Technologie des Propergols Solides, offers otherwise unavailable information on the subject of solid propellants and their use in rocket propulsion. The fundamentals of rocket propulsion are developed in chapter one and detailed descriptions of concepts are covered in the following chapters. Specific design methods and the theoretical physics underlying them are presented, and finally the industrial production of the propellant itself is explained. The material used in the book has been collected from different countries, as the development of this field has occurred separately due to the classified nature of the subject. Thus the reader not only has an overall picture of solid rocket propulsion technology but a comprehensive view of its different developmental permutations worldwide.

Rocket Propulsion Elements George Paul Sutton 1963

Solid Propellant Chemistry Combustion and Motor Interior Ballistics 1999 Vigor Yang 2000