Mathematical Models With Applications Texas Edition Answers

This volume synthesizes theoretical and practical aspects of both the mathematical and life science viewpoints needed for modeling of the cardiovascular-respiratory system specifically and physiological systems generally. Theoretical points include model design, model complexity and validation in the light of available data, as well as control theory approaches to feedback delay and Kalman filter applications to parameter identification. State of the art approaches using parameter sensitivity are discussed for enhancing model identifiability through joint analysis of model structure and data. Practical examples illustrate model development at various levels of complexity based on given physiological information. The sensitivity-based approaches for examining model identifiability are illustrated by means of specific modeling examples. The themes presented address the current problem of patient-specific model adaptation in the clinical setting, where data is typically limited.

Mathematical statistics typically represents one of the most difficult challenges in statistics, particularly for those with more applied, rather than mathematical, interests and backgrounds. Most textbooks on the subject provide little or no review of the advanced calculus topics upon which much of mathematical statistics relies and furthermore contain material that is wholly theoretical, thus presenting even greater challenges to those interested in applying advanced statistics to a specific area. Mathematical Statistics with Applications presents the background concepts and builds the technical sophistication needed to move on to more advanced studies in multivariate analysis, decision theory, stochastic processes, or computational statistics. Applications embedded within theoretical discussions clearly demonstrate the utility of the theory in a useful and relevant field of application and allow readers to avoid sudden exposure to purely theoretical materials. With its clear explanations and more than usual emphasis on applications and computation, this text reaches out to the many students and professionals more interested in the practical use of statistics to enrich their work in areas such as communications, computer science, economics, astronomy, and public health.

Granular matter displays a variety of peculiarities that distinguish it from other appearances studied in condensed matter physics and renders its overall mathematical modelling somewhat arduous. Prominent directions in the modelling granular flows are analyzed from various points of view. Foundational issues, numerical schemes and experimental results are discussed. The volume furnishes a rather complete overview of the current research trends in the mechanics of granular matter. Various chapters introduce the reader to different points of view and related techniques. New models describing granular bodies as complex bodies are presented. Results on the analysis of the inelastic Boltzmann equations are collected in different chapters. Gallavotti-Cohen symmetry is also discussed.

Much of what engineers and scientists do is to model natural phenomena. They develop mathematical models of nature so as to study and predict the behavior of physical systems. The remarkable advances in technology over the last half century attest to the success of this approach. Mathematical models do indeed work. Their use represents a proven approach toward scientific discovery and engineering analyses and design, and one can safely predict that the confidence in results of mathematical modeling will grow as further proof and experience accumulates as to their utility and their reliability. Indeed, it is this latter quality, reliability, that emerges as the key to further progress in computational mechanics. There has been growing concern about the issue of reliability in computational modeling in recent years. The papers presented at the Workshop fell into four broad categories: (1) Mathematical modeling; (2) A priori analysis, including principles of convergence, robustness and their reliability; (3) A posteriori analysis, including adaptive methods; and (4) Computer aspects of modeling such as mesh generation, solid modeling and their reliability. In addition, papers on parallel computing, applications to practical problems, selection of benchmark problems for code verification, and related issues were discussed. The majority of the paper focused on finite element methods and their applications, but a number of papers also dealt with boundary element methods, finite difference methods, and spectral methods as well.
Nonlinear Systems and Applications: An International Conference contains the proceedings of an International Conference on Nonlinear Systems and Applications held at the University of Texas at Arlington, on July 19-23, 1976. The conference provided a forum for reviewing advances in nonlinear systems and their applications and tackled a wide array of topics ranging from abstract evolution equations and nonlinear semigroups to controllability and reachability. Various methods used in solving equations are also discussed, including approximation techniques for delay systems. Most of the applications are in the area of the life sciences. Comprised of 59 chapters, this book begins with a discussion on monotonically convergent upper and lower bounds for classes of conflicting populations, followed by an analysis of constrained problems. The reader is then introduced to approximation techniques for delay systems in biological models; differential inequalities for Liapunov functions; and stability or chaos in discrete epidemic models. Subsequent chapters deal with nonlinear boundary value problems for elliptic systems; bounds for solutions of reaction-diffusion equations; monotonicity and measurability; and periodic solutions of some integral equations from the theory of epidemics. This monograph will be helpful to students, practitioners, and researchers in the field of mathematics.
This book is a collection of lecture notes for the CIME course on "Multiscale and Adaptivity: Modeling, Numerics and Applications," held in Cetraro (Italy), in July 2009. Complex systems arise in several physical, chemical, and biological processes, in which length and time scales may span several orders of magnitude. Traditionally, scientists have focused on methods that are particularly applicable in only one regime, and knowledge of the system on one scale has been

transferred to another scale only indirectly. Even with modern computer power, the complexity of such systems precludes their being treated directly with traditional tools, and new mathematical and computational instruments have had to be developed to tackle such problems. The outstanding and internationally renowned lecturers, coming from different areas of Applied Mathematics, have themselves contributed in an essential way to the development of the theory and techniques that constituted the subjects of the courses.

Mathematical Models is a component of Encyclopedia of Mathematical Sciences in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. The Theme on Mathematical Models discusses matters of great relevance to our world such as: Basic Principles of Mathematical Modeling; Mathematical Models in Water Sciences; Mathematical Models in Energy Sciences; Mathematical Models of Climate and Global Change; Infiltration and Ponding; Mathematical Models of Biology; Mathematical Models in Medicine and Public Health; Mathematical Models of Society and Development. These three volumes are aimed at the following five major target audiences: University and College students Educators, Professional practitioners, Research personnel and Policy analysts, managers, and decision makers and NGOs.

Applied Biomechatronics Using Mathematical Models provides an appropriate methodology to detect and measure diseases and injuries relating to human kinematics and kinetics. It features mathematical models that, when applied to engineering principles and techniques in the medical field, can be used in assistive devices that work with bodily signals. The use of data in the kinematics and kinetics analysis of the human body, including musculoskeletal kinetics and joints and their relationship to the central nervous system (CNS) is covered, helping users understand how the complex network of symbiotic systems in the skeletal and muscular system work together to allow movement controlled by the CNS. With the use of appropriate electronic sensors at specific areas connected to bio-instruments, we can obtain enough information to create a mathematical model for assistive devices by analyzing the kinematics and kinetics of the human body. The mathematical models developed in this book can provide more effective devices for use in aiding and improving the function of the body in relation to a variety of injuries and diseases. Focuses on the mathematical modeling of human kinematics and kinetics Teaches users how to obtain faster results with these mathematical models Includes a companion website with additional content that presents MATLAB examples

The volume presents a selection of in-depth studies and state-of-the-art surveys of several challenging topics that are at the forefront of modern applied mathematics, mathematical modeling, and computational science. These three areas represent the foundation upon which the methodology of mathematical modeling and computational experiment is built as a ubiquitous tool in all areas of mathematical applications. This book covers both fundamental and applied research, ranging from studies of elliptic curves over finite fields with their applications to cryptography, to dynamic blocking problems, to random matrix theory with its innovative applications. The book provides the reader with state-of-the-art achievements in the development and application of new theories at the interface of applied mathematics, modeling, and computational science. This book aims at fostering interdisciplinary collaborations required to meet the modern challenges of applied mathematics, modeling, and computational science. At the same time, the contributions combine rigorous mathematical and computational procedures and examples from applications ranging from engineering to life sciences, providing a rich ground for graduate student projects.

This book constitutes the refereed proceedings of the 11th Annual Conference on Theory and Applications of Models of Computation, TAMC 2014, held in Chennai, India, in April 2014. The 27 revised full papers presented were carefully reviewed and selected from 112 submissions. The papers explore the algorithmic foundations, computational methods and computing devices to meet today's and tomorrow's challenges of complexity, scalability and sustainability, with wide-ranging impacts on everything from the design of biological systems to the understanding of economic markets and social networks.

Mathematical Models with ApplicationsAn Introduction to Mathematical ModelingA Course in MechanicsJohn Wiley & Sons

Mathematical Models in Biology is an introductory book for readers interested in biological applications of mathematics and modeling in biology. A favorite in the mathematical biology community, it shows how relatively simple mathematics can be applied to a variety of models to draw interesting conclusions. Connections are made between diverse biological examples linked by common mathematical themes. A variety of discrete and continuous ordinary and partial differential equation models are explored. Although great advances have taken place in many of the topics covered, the simple lessons contained in this book are still important and informative. Audience: the book does not assume too much background knowledge--essentially some calculus and high-school algebra. It was originally written with third- and fourth-year undergraduate mathematical-biology majors in mind; however, it was picked up by beginning graduate students as well as researchers in math (and some in biology) who wanted to learn about this field.

Topological surgery is a mathematical technique used for creating new manifolds out of known ones. In this book the authors observe that it also occurs in natural phenomena of all scales: 1-dimensional surgery happens during DNA recombination and when cosmic magnetic lines reconnect; 2-dimensional surgery happens during tornado formation and cell mitosis; and they conjecture that 3-dimensional surgery happens during the formation of black holes from cosmic strings, offering an explanation for the existence of a black hole’s singularity. Inspired by such phenomena, the authors present a new topological model that extends the formal definition to a continuous process caused by local forces. Lastly, they describe an intrinsic connection between topological surgery and a chaotic dynamical system exhibiting a “hole drilling” behavior. The authors’ model indicates where to look for the forces causing surgery and what deformations should be observed in the local submanifolds involved. These predictions are significant for the study of phenomena exhibiting surgery and they also open new research directions. This novel study enables readers to gain a better understanding of the topology and dynamics of various natural phenomena, as well as

topological surgery itself and serves as a basis for many more insightful observations and new physical implications.
The present volume contains invited talks of 11th biennial conference on “Emerging Mathematical Methods, Models and Algorithms for Science and Technology”. The main message of the book is that mathematics has a great potential to analyse and understand the challenging problems of nanotechnology, biotechnology, medical science, oil industry and financial technology. The book highlights all the features and main theme discussed in the conference. All contributing authors are eminent academicians, scientists, researchers and scholars in their respective fields, hailing from around the world.
Comprehensive account of some of the most popular models of small watershed hydrology and application ~~ of interest to all hydrologic modelers and model users and a welcome and timely edition to any modeling library
This book constitutes the refereed conference proceedings of the 7th International Conference on Finite Difference Methods, FDM 2018, held in Lozenetz, Bulgaria, in June 2018.The 69 revised full papers presented together with 11 invited papers were carefully reviewed and selected from 94 submissions. They deal with many modern and new numerical techniques like splitting techniques, Green’s function method, multigrid methods, and immersed interface method.
This book presents applications of geometric optimal control to real life biomedical problems with an emphasis on cancer treatments. A number of mathematical models for both classical and novel cancer treatments are presented as optimal control problems with the goal of constructing optimal protocols. The power of geometric methods is illustrated with fully worked out complete global solutions to these mathematically challenging problems. Elaborate constructions of optimal controls and corresponding system responses provide great examples of applications of the tools of geometric optimal control and the outcomes aid the design of simpler, practically realizable suboptimal protocols. The book blends mathematical rigor with practically important topics in an easily readable tutorial style. Graduate students and researchers in science and engineering, particularly biomathematics and more mathematical aspects of biomedical engineering, would find this book particularly useful.
Provides a concise overview of stochastic models and mathematical techniques for solving challenging mathematical and statistical problems and enhances readers' overall understanding of communication systems. The book also presents an excellent introduction to a huge area of interesting problems and models arising from modern developments in broadband channel transmission systems.
In many respects, biology is the new frontier for applied mathematicians. This book demonstrates the important role mathematics plays in the study of some biological problems. It introduces mathematicians to the biological sciences and provides enough mathematics for bioscientists to appreciate the utility of the modelling approach. The book presents a number of diverse topics, such as neurophysiology, cell biology, immunology, and human genetics. It examines how research is done,what mathematics is used, what the outstanding questions are, and how to enter the field. Also given is a brief historical survey of each topic, putting current research into perspective. The book is suitable for mathematicians and biologists interested in mathematical methods in biology.
This book gathers outstanding papers presented at the European Conference on Numerical Mathematics and Advanced Applications (ENUMATH 2019). The conference was organized by Delft University of Technology and was held in Egmond aan Zee, the Netherlands, from September 30 to October 4, 2019. Leading experts in the field presented the latest results and ideas regarding the design, implementation and analysis of numerical algorithms, as well as their applications to relevant societal problems. ENUMATH is a series of conferences held

every two years to provide a forum for discussing basic aspects and new trends in numerical mathematics and scientific and industrial applications, all examined at the highest level of international expertise. The first ENUMATH was held in Paris in 1995, with successive installments at various sites across Europe, including Heidelberg (1997), Jyvaskyla (1999), lschia Porto (2001), Prague (2003), Santiago de Compostela (2005), Graz (2007), Uppsala (2009), Leicester (2011), Lausanne (2013), Ankara (2015) and Bergen (2017).

This volume contains a collection of papers in control theory and applications presented at a conference in honor of Clyde Martin on the occasion of his 60th birthday, held in Lubbock, Texas, November 14-15, 2003.

The first international symposium on mathematical foundations of the finite element method was held at the University of Maryland in 1973. During the last three decades there has been great progress in the theory and practice of solving partial differential equations, and research has extended in various directions. Full-scale nonlinear problems have come within the range of nu merical simulation. The importance of mathematical modeling and analysis in science and engineering is steadily increasing. In addition, new possibili ties of analysing the reliability of computations have appeared. Many other developments have occurred: these are only the most noteworthy. This book is the record of the proceedings of the International Sympo sium on Mathematical Modeling and Numerical Simulation in Continuum Mechanics, held in Yamaguchi, Japan from 29 September to 3 October 2000. The topics covered by the symposium ranged from solids to fluids, and in cluded both mathematical and computational analysis of phenomena and algorithms. Twenty-one invited talks were delivered at the symposium. This volume includes almost all of them, and expresses aspects of the progress mentioned above. All the papers were individually refereed. We hope that this volume will be a stepping-stone for further developments in this field.

This proceedings contains seven invited papers and 100 contributed papers. The topics covered range from studies of theoretical aspects of computational methods through to simulations of large-scale industrial processes, with an emphasis on the efficient use of computers to solve practical problems. Developers and users of computational techniques who wish to keep up with recent developments in the application of modern computational technology to problems in science and engineering will find much of interest in this volume. Contents:Some Case Studies in Industrial Mathematics (F R de Hoog & N I Robinson)An Inverse Problem in Environmental Protection (J M Barry)Computational Techniques for Structural Assessment of Bridges (T Chalko et al)A Computationally Fast Method to Model Thin Strip Rolling (A E Dixon & W Y D Yuen)Comparison of Boundary Element Representations for Potential Fields (M J Drumm & T G Phemister)On the Computation of Stability Limits for Fusion Experiments (P R Garabedian & H J Gardner)The Finite Lattice Method of Series Expansions (I Jensen et al)A Comparison of Finite Difference and Lagrangian-Stochastic Methods for Oil Slick Tracking (G D Lewis et al)Numerical Modelling Techniques for Simulating the Microwave Heating of Polymer Materials Inside a Ridge Waveguide (F Liu & I Turner)Transport of Mucus (A H Pincombe & G D Tansley)Iterative Schemes for Series Solutions to Laplacian Free Boundary Problems (W W Read et al)A Systematic Approach to Calibrating Hydrodynamic Numerical Models (M D Teubner et al)Computation of Turbulent Combustion Flows with a Finite-Element Method (Z Zhu & N Stokes)and other papers Readership: Scientists in numerical and computational methods, applied mathematics, computational physics, supercomputing/parallel processing and fluid mechanics. keywords:

This book introduces mathematicians to real applications from physiology. Using mathematics to analyze physiological systems, the authors focus on models reflecting current research in cardiovascular and pulmonary physiology. In particular, they present models describing blood flow in the heart and the cardiovascular system, as well as the transport of oxygen and carbon dioxide through the respiratory system and a model for baroreceptor regulation.

Partial differential equations (PDEs) are used to describe a large variety of physical phenomena, from fluid flow to electromagnetic fields, and are indispensable to such disparate fields as aircraft simulation and computer graphics. While most existing texts on PDEs deal with either analytical or numerical aspects of PDEs, this innovative and comprehensive textbook features a unique approach that integrates analysis and numerical solution methods and includes a third component - modeling - to address real-life problems. The authors believe that modeling can be learned only by doing; hence a separate chapter containing 16 user-friendly case studies of elliptic, parabolic, and hyperbolic equations is included and numerous exercises are included in all other chapters.
Mathematical Models in Finance compiles papers presented at the Royal Society of London discussion meeting. Topics range from the foundations of classical theory to sophisticated, up-to-date mathematical modeling and analysis. In the wake of the increased level of mathematical awareness in the financial research community, attention has focused on fundamental issues of market modelling that are not adequately allowed for in the standard analyses. Examples include market anomalies and nonlinear coupling effects, and demand new synthesis of mathematical and numerical techniques. This line of inquiry is further stimulated by ever tightening profits due to increased competition. Several papers in this volume offer pointers to future developments in this area.
A modern approach to mathematical modeling, featuring unique applications from the field of mechanics An Introduction to Mathematical Modeling: A Course in Mechanics is designed to survey the mathematical models that form the foundations of modern science and incorporates examples that illustrate how the most successful models arise from basic principles in modern and classical mathematical physics. Written by a world authority on mathematical theory and computational mechanics, the book presents an account of continuum mechanics, electromagnetic field theory, quantum mechanics, and statistical mechanics for readers with varied backgrounds in engineering, computer science, mathematics, and physics. The author streamlines a comprehensive understanding of the topic in three clearly organized sections: Nonlinear Continuum Mechanics introduces kinematics as well as force and stress in deformable bodies; mass and momentum; balance of linear and angular momentum; conservation of energy; and constitutive equations Electromagnetic Field Theory and Quantum Mechanics contains a brief account of electromagnetic wave theory and Maxwell's equations as well as an introductory account of quantum mechanics with related topics including ab initio methods and Spin and Pauli's principles Statistical Mechanics presents an introduction to statistical mechanics of systems in thermodynamic equilibrium as well as continuum mechanics, quantum mechanics, and molecular dynamics Each part of the book concludes with exercise sets that allow readers to test their understanding of the presented material. Key theorems and fundamental equations are highlighted throughout, and an extensive bibliography outlines resources for further study. Extensively class-tested to ensure an accessible presentation, An Introduction to Mathematical Modeling is an excellent book for courses on introductory mathematical modeling and statistical mechanics at the upper-undergraduate and graduate levels. The book also serves as a valuable reference for professionals working in the areas of modeling and simulation, physics, and computational engineering.

The demand for more computing power has been a constant trend in many fields of science, engineering and business. Now more than ever, the need for more and more processing power is emerging in the resolution of complex problems from life sciences, financial services, drug discovery, weather forecasting, massive data processing for e-science, e-commerce and e-government etc. Grid and P2P paradigms are based on the premise to deliver greater computing power at less cost, thus enabling the solution of such complex problems. Parallel Programming, Models and Applications in Grid and P2P Systems presents recent advances for grid and P2P paradigms, middleware, programming models, communication libraries, as well as their application to the resolution of real-life problems. By approaching grid and P2P paradigms in an integrated and comprehensive way, we believe that this book will serve as a reference for researchers and developers of the grid and P2P computing communities. Important features of the book include an up-to-date survey of grid and P2P programming models, middleware and communication libraries, new approaches for modeling and performance analysis in grid and P2P systems, novel grid and P2P middleware as well as grid and P2P-enabled applications for real-life problems. Academics, scientists, software developers and engineers interested in the grid and P2P paradigms will find the comprehensive coverage of this book useful for their academic, research and development activity.

This IMA Volume in Mathematics and its Applications RESOURCE RECOVERY, CONFINEMENT, AND REMEDIATION OF ENVIRONMENTAL HAZARDS contains papers presented at two successful one-week workshops: Confine ment and Remediation of Environmental Hazards held on January 15-19, 2000 and Resource Recovery, February 9-13, 2000. Both workshops were integral parts of the IMA annual program on Mathematics in Reactive Flow and Transport Phenomena, 1999-2000. We would like to thank John Chadam (University of Pittsburgh), Al Cunningham (Montana State Uni versity), Richard E. Ewing (Texas A&M University), Peter Ortoleva (In diana University), and Mary Fanett Wheeler (TICAM, The University of Texas at Austin) for their excellent work as organizers of the meetings and for editing the proceedings. We take this opportunity to thank the National Science Foundation for their support of the IMA. Series Editors Douglas N. Arnold, Director of the IMA Fadil Santosa, Deputy Director of the IMA v PREFACE Advances in resource recovery, and confinement/remediation of envi ronmental hazards requires a coordinated, interdisciplinary effort involving mathematicians, scientists and engineers. The intent of this collection of papers is to summarize recent theoretical, computational, and experimen tal advances in the theory of phenomena in porous media, with the intent to identify similarities and differences concerning applications related to both resource recovery and confinement and remediation of environmental hazards.

This book collects select papers presented at the “International Conference on Mathematical Analysis and Application in Modeling,” held at Jadavpur University, Kolkata, India, on 9–12 January 2018. It discusses new results in cutting-edge areas of several branches of mathematics and applications, including analysis, topology, dynamical systems (nonlinear, topological), mathematical modeling, optimization and mathematical biology. The conference has emerged as a powerful forum, bringing together leading academics, industry experts and researchers, and offering them a venue to discuss, interact and collaborate in order to stimulate the advancement of mathematics and its industrial applications.

The only book that details the mathematical models that help creditors make intelligent credit risk decisions.

Presenting a state-of-the-art overview of theoretical and computational models that link characteristic biomechanical phenomena, this book provides guidelines and examples for creating multiscale models in representative systems and organisms. It develops the reader's understanding of and intuition for multiscale phenomena in biomechanics and mechanobiology, and introduces a mathematical framework and computational techniques paramount to creating predictive multiscale models. Biomechanics involves the study of the interactions of physical forces with biological systems at all scales – including molecular, cellular, tissue and organ scales. The emerging field of mechanobiology focuses on the way that cells produce and respond to mechanical forces – bridging the science of mechanics with the disciplines of genetics and molecular biology. Linking disparate spatial and temporal scales using computational techniques is emerging as a key concept in investigating some of the complex problems underlying these disciplines. Providing an invaluable field manual for graduate students and researchers of theoretical and computational modelling in biology, this book is also intended for readers interested in biomedical engineering, applied mechanics and mathematical biology.

There is at present a growing body of opinion that in the decades ahead discrete mathematics (that is, "noncontinuous mathematics"), and therefore parts of applicable modern algebra, will be of increasing importance. Cer tainly, one reason for this opinion is the rapid development of computer science, and the use of discrete mathematics as one of its major tools. The purpose of this book is to convey to graduate students or to final-year undergraduate students the fact that the abstract algebra encountered pre viously in a first algebra course can be used in many areas of applied mathematics. It is often the case that students who have studied mathematics go into postgraduate work without any knowledge of the applicability of the structures they have studied in an algebra course. In recent years there have emerged courses and texts on discrete mathe matics and applied algebra. The present text is meant to add to what is available, by focusing on three subject areas. The contents of this book can be described as dealing with the following major themes: Applications of Boolean algebras (Chapters 1 and 2). Applications of finite fields (Chapters 3 to 5). Applications of semigroups (Chapters 6 and 7).

A description of the latest and most appropriate mathematical and numerical methods for optimizing soil venting. The monograph considers mathematical, numerical, and technical aspects as well as their practical significance. This book will be of interest to applied mathematicians, geophysicists, geoecologists, soil physicists, and environmental engineers.

This monograph provides a summary of the basic theory of branching processes for single-type and multi-type processes. Classic examples of population and epidemic models illustrate the probability of population or epidemic extinction obtained from the theory of branching processes. The first chapter develops the branching process theory, while in the second chapter two applications to population and epidemic processes of single-type branching process theory are explored. The last two chapters present multi-type branching process applications to epidemic models, and then continuous-time and continuous-state branching processes with applications. In addition, several MATLAB programs for simulating stochastic sample paths are provided in an Appendix. These notes originated as part of a lecture series on Stochastics in Biological Systems at the Mathematical Biosciences Institute in Ohio, USA. Professor Linda Allen is a Paul Whitfield Horn Professor of Mathematics in the Department of Mathematics and Statistics at Texas Tech University, USA.

This thesis introduces a mathematical model of differential equations for the chronic hepatitis C virus (HCV) infection, which is a contagious disease that infects the liver cells. Firstly, we present the early mathematical models for the basic dynamics of virus infection that developed and analyzed to understand the dynamics of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and some other viruses. Next, we present the extended model of the basic HCV virus dynamics that incorporate the effectiveness of a treatment. After that, the mathematical model that includes proliferation terms for both infected and uninfected hepatocytes is discussed. Lastly, the mathematical model that is considering the interaction between HCV virus and immune responses in a host is introduced. In this thesis, we formulate an ordinary differential equations (ODE) model to describe the interactions between the hepatitis C (HCV) virus and the immune system in a human body under treatment, taking into consideration the proliferation for both infected and uninfected hepatocytes. Analysis of the model reveals the existence of multiple equilibrium states: the disease-free steady state in which no virus is present, an infected state with no immune responses, an infected steady state with immune responses in which virus and infected cells are present, an infected steady state with dominant CTLs responses in which no antibody (B-cell) is present, an infected steady state with dominant antibody responses in which no CTLs is present, and an infected steady state with coexistence responses in which all are present. Finally, we run simulations and compare our model to other models in the literature. In addition, several different scenarios were numerically simulated to demonstrate the practical applications of the mathematical model.