

# Engineering Mechanics Dynamics 5th Edition

## Bedford Fowler

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using a step by step approach this textbook provides a modern treatment of the fundamental concepts analytical techniques and software tools used to perform multi domain modeling system analysis and simulation linear control system design and implementation and advanced control engineering chapters follow a progressive structure which builds from modeling fundamentals to analysis and advanced control while showing the interconnections between topics and solved problems and examples are included throughout students can easily recall key topics and test understanding using review note and concept quiz boxes and over 200 end of chapter homework exercises with accompanying concept keys are included focusing on practical

understanding students will gain hands on experience of many modern matlab tools including simulink and physical modeling in simscapetm with a solutions manual matlab code and simulink simscapetm files available online this is ideal for senior undergraduates taking courses on modeling analysis and control of dynamic systems as well as graduates studying control engineering

the revision of this classic text continues to provide the same high quality material seen in previous editions in addition the fifth edition provides extensively rewritten updated prose for content clarity superb new problems in new application areas outstanding instruction on drawing free body diagrams and new electronic supplements to assist learning and instruction if you think you have seen meriam kraige before take another look it s not what you remember it to be it s better based problem solving egrade gives students opportunity to practice solving problems with immediate feedback computational mechanics booklets offer flexibility in introducing matlab mathcad and or maple into your mechanics classroom electronic figures from the text allow you to enhance your lectures by pulling material from the text into your powerpoint or other lecture formats 100 additional electronic transparencies offer problem statements and fully worked solutions for use in lecture or as outside study tools for students

this volume offers a concise presentation of engineering mechanics theory and application the material is reinforced with numerous examples to illustrate principles and imaginative problems of varying degrees of difficulty

this book highlights recent findings in industrial manufacturing and mechanical engineering and provides an overview of the state of the art in these fields mainly in russia and eastern europe a broad range of topics and issues in modern engineering are discussed including the dynamics of machines and working processes friction wear and lubrication in machines surface transport and technological machines manufacturing engineering of industrial facilities materials engineering metallurgy control systems and their industrial applications industrial mechatronics automation and robotics the book gathers selected papers presented at the 5th international conference on industrial engineering icie held in sochi russia in march 2019 the authors are experts in various fields of engineering and all papers have been carefully reviewed given its scope the book will be of interest to a wide readership including mechanical and production engineers lecturers in engineering disciplines and engineering graduates

a thorough study of the oscillatory and transient motion of mechanical and structural systems engineering vibrations second edition presents vibrations from a unified point of view and builds on the first edition with additional chapters and sections that contain

more advanced graduate level topics using numerous examples and case studies the author reviews basic principles incorporates advanced abstract concepts from first principles and weaves together physical interpretation and fundamental principles with applied problem solving this revised version combines the physical and mathematical facets of vibration and emphasizes the connecting ideas concepts and techniques

an effective text must be well balanced and thorough in its approach to a topic as expansive as vibration and mechanical vibration is just such a textbook written for both senior undergraduate and graduate course levels this updated and expanded second edition integrates uncertainty and control into the discussion of vibration outlining basic concepts before delving into the mathematical rigors of modeling and analysis mechanical vibration analysis uncertainties and control second edition provides example problems end of chapter exercises and an up to date set of mini projects to enhance students computational abilities and includes abundant references for further study or more in depth information the author provides a matlab primer on an accompanying cd rom which contains original programs that can be used to solve complex problems and test solutions the book is self contained covering both basic and more advanced topics such as stochastic processes and variational approaches it concludes with a completely new chapter on nonlinear vibration and stability professors will find that the logical sequence of material is ideal for tailoring individualized syllabi and students will benefit from the abundance of problems and matlab programs provided in the text and on the accompanying cd rom respectively a solutions manual is also available with qualifying course adoptions

this book is all about mechanisms and machines one of the most important core subjects of mechanical engineering there are many ways a mechanism can be configured and there are many mechanisms in a machine creating a tremendous opportunity to build better machines of our choice to do so however one needs to understand the common thread present in the thousands of configurations and to break them down into a set of rules this book does exactly that using the same set of rules consistently to explain the design of any mechanism or machine pedagogical tools and approaches have been utilized to make it easier and more interesting for the student extensive illustrations simple explanations and exercise problems with useful hints have been included the systematic use of a vector based approach makes learning easier and helps extend the knowledge acquired in this book to applications in robotics

mechanics using matlab an introductory guide bridges the gap between fundamental principles of mechanics and their practical implementation using matlab a powerful

computational tool widely used in engineering and scientific applications we offer an invaluable resource for students educators and professionals seeking to deepen their understanding of classical mechanics and enhance their problem solving skills through computational techniques we begin by laying a solid foundation in core concepts of mechanics including kinematics dynamics and energy principles through clear explanations and illustrative examples we guide readers through essential theories and equations governing the motion of particles and rigid bodies emphasis is placed on developing a conceptual understanding of the underlying physics reinforced through matlab based exercises and simulations one of the key strengths of our book lies in its integration of theory with practical application each chapter elucidates the theoretical framework and demonstrates how to implement it computationally using matlab scripts and functions topics covered include particle dynamics projectile motion newton s laws of motion circular motion conservation principles rotational dynamics oscillations and orbital mechanics throughout the text matlab code snippets are provided alongside explanations allowing readers to gain hands on experience in solving mechanics problems numerically this interactive approach reinforces theoretical concepts and equips readers with valuable computational skills with worked examples and practice problems mechanics using matlab an introductory guide challenges readers and reinforces their understanding this book serves as a practical reference for engineers scientists and researchers in fields where mechanics plays a crucial role

this textbook gives an introduction to fluid dynamics based on flows for which analytical solutions exist like individual vortices vortex streets vortex sheets accretions disks wakes jets cavities shallow water waves bores tides linear and non linear free surface waves capillary waves internal gravity waves and shocks advanced mathematical techniques calculus are introduced and applied to obtain these solutions mostly from complex function theory schwarz christoffel theorem and wiener hopf technique exterior calculus singularity theory asymptotic analysis the theory of linear and nonlinear integral equations and the theory of characteristics many of the derivations so far contained only in research journals are made available here to a wider public

this handbook covers the peridynamic modeling of failure and damage peridynamics is a reformulation of continuum mechanics based on integration of interactions rather than spatial differentiation of displacements the book extends the classical theory of continuum mechanics to allow unguided modeling of crack propagation fracture in brittle quasi brittle and ductile materials autonomous transition from continuous damage fragmentation to fracture modeling of long range forces within a continuous body and multiscale coupling in a consistent mathematical framework

parallel structures are more effective than serial ones for industrial automation applications that require high precision and stiffness or a high load capacity relative to robot weight although many industrial applications have adopted parallel structures for their design few textbooks introduce the analysis of such robots in terms of dynamics and control filling this gap parallel robots mechanics and control presents a systematic approach to analyze the kinematics dynamics and control of parallel robots it brings together analysis and design tools for engineers and researchers who want to design and implement parallel structures in industry covers kinematics dynamics and control in one volume the book begins with the representation of motion of robots and the kinematic analysis of parallel manipulators moving beyond static positioning it then examines a systematic approach to performing jacobian analysis a special feature of the book is its detailed coverage of the dynamics and control of parallel manipulators the text examines dynamic analysis using the newton euler method the principle of virtual work and the lagrange formulations finally the book elaborates on the control of parallel robots considering both motion and force control it introduces various model free and model based controllers and develops robust and adaptive control schemes it also addresses redundancy resolution schemes in detail analysis and design tools to help you create parallel robots in each chapter the author revisits the same case studies to show how the techniques may be applied the case studies include a planar cable driven parallel robot part of a promising new generation of parallel structures that will allow for larger workspaces the matlab code used for analysis and simulation is available online combining the analysis of kinematics and dynamics with methods of designing controllers this text offers a holistic introduction for anyone interested in designing and implementing parallel robots

the proceedings contain contributions presented by authors from more than 30 countries at eurodyn 2002 the proceedings show recent scientific developments as well as practical applications they cover the fields of theory of vibrations nonlinear vibrations stochastic dynamics vibrations of structured elements wave propagation and structure borne sound including questions of fatigue and damping emphasis is laid on vibrations of bridges buildings railway structures as well as on the fields of wind and earthquake engineering respectively enriched by a number of keynote lectures and organized sessions the two volumes of the proceedings present an overview of the state of the art of the whole field of structural dynamics and the tendencies of its further development

engineering mechanics involves the development of mathematical models of the physical world statics addresses the forces acting on and in mechanical objects and systems statics with matlab develops an understanding of the mechanical behavior of

complex engineering structures and components using matlab to execute numerical calculations and to facilitate analytical calculations matlab is presented and introduced as a highly convenient tool to solve problems for theory and applications in statics included are example problems to demonstrate the matlab syntax and to also introduce specific functions dealing with statics these explanations are reinforced through figures generated with matlab and the extra material available online which includes the special functions described this detailed introduction and application of matlab to the field of statics makes statics with matlab a useful tool for instruction as well as self study highlighting the use of symbolic matlab for both theory and applications to find analytical and numerical solutions

this book provides a focused presentation of the physical and mathematical ideas upon which graduate work in fluid mechanics depends the book includes a self contained derivation of the governing equations followed by examples of their application numerous opportunities are provided to employ matlab in the study of fluid flows

die Überarbeitung für die 10 deutschsprachige auflage von hermann schlichtings standardwerk wurde wiederum von klaus gersten geleitet der schon die umfassende neuformulierung der 9 auflage vorgenommen hatte es wurden durchgängig aktualisierungen vorgenommen aber auch das kapitel 15 von herbert oertel jr neu bearbeitet das buch gibt einen umfassenden Überblick über den einsatz der grenzschicht theorie in allen bereichen der strömungsmechanik dabei liegt der schwerpunkt bei den umströmungen von körpern z b flugzeugaerodynamik das buch wird wieder den studenten der strömungsmechanik wie auch industrie ingenieuren ein unverzichtbarer partner unerschöpflicher informationen sein

this book presents the fundamental concepts of modeling and analysis of vibrations in mechanical systems with one or more degrees of freedom the presentation of classic topics is enriched by discussions on equilibrium stability and the linearization of the equations of motion practical examples throughout the text illustrate the applicability of the theory and explore the physics behind the equations this book includes various matlab codes which allow readers to modify parameters and investigate the behavior of a wide range of mechanical systems furthermore it is demonstrated how some of the mechanical systems studied can be constructed using ordinary materials enabling readers to compare the theoretical results predicted by the mathematical models with the actual observed behavior

this book is a comprehensive treatment of engineering undergraduate differential equations as well as linear vibrations and feedback control while this material has

traditionally been separated into different courses in undergraduate engineering curricula this text provides a streamlined and efficient treatment of material normally covered in three courses ultimately engineering students study mathematics in order to be able to solve problems within the engineering realm engineering differential equations theory and applications guides students to approach the mathematical theory with much greater interest and enthusiasm by teaching the theory together with applications additionally it includes an abundance of detailed examples appendices include numerous c and fortran example programs this book is intended for engineering undergraduate students particularly aerospace and mechanical engineers and students in other disciplines concerned with mechanical systems analysis and control prerequisites include basic and advanced calculus with an introduction to linear algebra

this book explores the mechanics of rotor spinning machines it discusses the open end spinning machine rotor s vibrations and bearings as well as the kinematics of the rotor s drive as individual drive or central drive both as a reducing drive and multiplying drive it examines explanations for the rotor s power requirements through different techniques such as shirley institute uk and zurich federal institute it also covers power distribution inside the machine different mechanisms of the machine and air flow inside the spinning machine

performance of the jet transport airplane analysis methods flight operations and regulations presents a detailed and comprehensive treatment of performance analysis techniques for jet transport airplanes uniquely the book describes key operational and regulatory procedures and constraints that directly impact the performance of commercial airliners topics include rigid body dynamics aerodynamic fundamentals atmospheric models including standard and non standard atmospheres height scales and altimetry distance and speed measurement lift and drag and associated mathematical models jet engine performance including thrust and specific fuel consumption models takeoff and landing performance with airfield and operational constraints takeoff climb and obstacle clearance level climbing and descending flight including accelerated climb descent cruise and range including solutions by numerical integration payload range endurance and holding maneuvering flight including turning and pitching maneuvers total energy concepts trip fuel planning and estimation including regulatory fuel reserves en route operations and limitations e g climb speed schedules cruise ceiling etops cost considerations e g cost index energy cost fuel tankering weight balance and trim flight envelopes and limitations including stall and buffet onset speeds v n diagrams environmental considerations viz noise and emissions aircraft systems and airplane performance e g cabin pressurization de anti icing and fuel



and performance related regulatory requirements of the faa federal aviation administration and easa european aviation safety agency key features describes methods for the analysis of the performance of jet transport airplanes during all phases of flight presents both analytical closed form methods and numerical approaches describes key faa and easa regulations that impact airplane performance presents equations and examples in both si système international and usc united states customary units considers the influence of operational procedures and their impact on airplane performance performance of the jet transport airplane analysis methods flight operations and regulations provides a comprehensive treatment of the performance of modern jet transport airplanes in an operational context it is a must have reference for aerospace engineering students applied researchers conducting performance related studies and flight operations engineers

this volume contains the proceedings of the 2000 international congress of theoretical and applied mechanics the book captures a snapshot view of the state of the art in the field of mechanics and will be invaluable to engineers and scientists from a variety of disciplines

now in its third edition essentials of strength training and conditioning is the most comprehensive reference available for strength and conditioning professionals in this text 30 expert contributors explore the scientific principles concepts and theories of strength training and conditioning as well as their applications to athletic performance essentials of strength training and conditioning is the most preferred preparation text for the certified strength and conditioning specialist cscs exam the research based approach extensive exercise technique section and unbeatable accuracy of essentials of strength training and conditioning make it the text readers have come to rely on for cscs exam preparation the third edition presents the most current strength training and conditioning research and applications in a logical format designed for increased retention of key concepts the text is organized into five sections the first three sections provide a theoretical framework for application in section 4 the program design portion of the book the final section offers practical strategies for administration and management of strength and conditioning facilities section 1 chapters 1 through 10 presents key topics and current research in exercise physiology biochemistry anatomy biomechanics endocrinology sport nutrition and sport psychology and discusses applications for the design of safe and effective strength and conditioning programs section 2 chapters 11 and 12 discusses testing and evaluation including the principles of test selection and administration as well as the scoring and interpretation of results section 3 chapters 13 and 14 provides techniques for warm up stretching and resistance

training exercises for each exercise accompanying photos and instructions guide readers in the correct execution and teaching of stretching and resistance training exercises this section also includes a set of eight new dynamic stretching exercises section 4 examines the design of strength training and conditioning programs the information is divided into three parts anaerobic exercise prescription chapters 15 through 17 aerobic endurance exercise prescription chapter 18 and periodization and rehabilitation chapters 19 and 20 step by step guidelines for designing resistance plyometric speed agility and aerobic endurance training programs are shared section 4 also includes detailed descriptions of how principles of program design and periodization can be applied to athletes of various sports and experience levels within the text special sidebars illustrate how program design variables can be applied to help athletes attain specific training goals section 5 chapters 21 and 22 addresses organization and administration concerns of the strength training and conditioning facility manager including facility design scheduling policies and procedures maintenance and risk management chapter objectives key points key terms and self study questions provide a structure to help readers organize and conceptualize the information unique application sidebars demonstrate how scientific facts can be translated into principles that assist athletes in their strength training and conditioning goals essentials of strength training and conditioning also offers new lecture preparation materials a product specific site includes new student lab activities that instructors can assign to students students can visit this site to print the forms and charts for completing lab activities or they can complete the activities electronically and email their results to the instructor the instructor guide provides a course description and schedule chapter objectives and outlines chapter specific sites and additional resources definitions of primary key terms application questions with recommended answers and links to the lab activities the presentation package and image bank delivered in microsoft powerpoint offers instructors a presentation package containing over 1 000 slides to help augment lectures and class discussions in addition to outlines and key points the resource also contains over 450 figures tables and photos from the textbook which can be used as an image bank by instructors who need to customize their own presentations easy to follow instructions help guide instructors on how to reuse the images within their own powerpoint templates these tools can be downloaded online and are free to instructors who adopt the text for use in their courses essentials of strength training and conditioning third edition provides the latest and most comprehensive information on the structure and function of body systems training adaptations testing and evaluation exercise techniques program design and organization and administration of facilities its accuracy and reliability make it not only the leading preparation resource for the cscs exam but also the definitive reference that strength and conditioning professionals and sports medicine specialists depend on to fine tune

their practice

a solid introduction to sound and vibration no formal background needed this second edition of fundamentals of sound and vibration covers the physical mathematical and technical foundations of sound and vibration at audio frequencies it presents acoustics vibration and the associated signal processing at a level suitable for graduate students

this book offers a critical review of current research in technology supported education focusing on the development and design of successful education programs student success factors and the creation and use of online courses provided by publisher

master the fundamentals of complex marine systems with this concrete introduction linking theory to real world engineering applications

modeling and analysis of dynamic systems third edition introduces matlab simulink and simscapetm and then utilizes them to perform symbolic graphical numerical and simulation tasks written for senior level courses modules the textbook meticulously covers techniques for modeling a variety of engineering systems methods of response analysis and introductions to mechanical vibration and to basic control systems these features combine to provide students with a thorough knowledge of the mathematical modeling and analysis of dynamic systems the third edition now includes case studies expanded coverage of system identification and updates to the computational tools included

this book deals with the simulation of the mechanical behavior of engineering structures mechanisms and components it presents a set of strategies and tools for formulating the mathematical equations and the methods of solving them using matlab for the same mechanical systems it also shows how to obtain solutions using a different approaches it then compares the results obtained with the two methods by combining fundamentals of kinematics and dynamics of mechanisms with applications and different solutions in matlab of problems related to gears cams and multilink mechanisms and by presenting the concepts in an accessible manner this book is intended to assist advanced undergraduate and mechanical engineering graduate students in solving various kinds of dynamical problems by using methods in matlab it also offers a comprehensive practice oriented guide to mechanical engineers dealing with kinematics and dynamics of several mechanical systems

manufacturing a product is not difficult the difficulty consists in manufacturing a product of high quality at a low cost and rapidly drastic technological advances are changing

global markets very rapidly in such conditions the ability to compete successfully must be based on innovative ideas and new products which has to be of high quality yet low in price one way to achieve these objectives would be through massive investments in research of computer based technology and by applying the approaches presented in this book the first international conference on advanced manufacturing systems and technology amst87 was held in opatija croatia in october 1987 the second international conference on advanced manufacturing systems and technology amsv90 was held in trento italy in june 1990 the third fourth fifth and sixth conferences on advanced manufacturing systems and technology were all held in udine italy as follows amst93 in april 1993 amst96 in september 1996 amst99 in june 1999 and amst02 in june 2002

market desc mechanical and civil engineers special features contains the strongest coverage on how to draw free body diagrams of any book on the market theory sections have been extensively rewritten new application areas especially biomechanics and new computer extension problems that introduce uses of computer tools for design and what if analysis about the book concise and authoritative this book sets the standard for excellence in basic mechanics texts the major emphasis is on basic principles and problem formulation strong effort has been made to show both the cohesiveness of the relatively few fundamental ideas and the great variety of problems that these ideas solve all of the problems deal with principles and procedures inherent in the design and analysis of engineering structures and mechanical systems with many of the problems referring explicitly to design considerations

handbook of fluid dynamics offers balanced coverage of the three traditional areas of fluid dynamics theoretical computational and experimental complete with valuable appendices presenting the mathematics of fluid dynamics tables of dimensionless numbers and tables of the properties of gases and vapors each chapter introduces a different fluid dynamics topic discusses the pertinent issues outlines proven techniques for addressing those issues and supplies useful references for further research covering all major aspects of classical and modern fluid dynamics this fully updated second edition reflects the latest fluid dynamics research and engineering applications includes new sections on emerging fields most notably micro and nanofluidics surveys the range of numerical and computational methods used in fluid dynamics analysis and design expands the scope of a number of contemporary topics by incorporating new experimental methods more numerical approaches and additional areas for the application of fluid dynamics handbook of fluid dynamics second edition provides an indispensable resource for professionals entering the field of fluid dynamics the book also enables experts specialized in areas outside fluid dynamics to become familiar with

the field

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# Plutonium Calories: A Misconception

## Demystified

The phrase "plutonium calories" might seem nonsensical at first glance. After all, we typically associate calories with food, providing energy for biological processes. Plutonium, a highly radioactive element, is far removed from the realm of nutrition. However, the question of "plutonium calories" touches upon a fundamental concept in physics: energy equivalence. This article will delve into this intriguing but ultimately misleading concept, clarifying the connection (or lack thereof) between plutonium and the calories we consume.

**I. What does "calorie" actually mean?** A calorie (specifically, a kilocalorie or kcal) is a unit of energy. In the context of food, it represents the amount of energy released when our bodies metabolize food molecules. This energy fuels our bodily functions, from breathing to movement. The calorie is a measure of heat energy – the amount of heat required to raise the temperature of one kilogram of water by one degree Celsius.

**II. How does energy relate to plutonium?** Plutonium, unlike food, doesn't release energy through metabolic processes. Instead, it releases energy through nuclear processes, primarily radioactive decay. This decay involves the spontaneous transformation of plutonium atoms into other elements, releasing vast amounts of energy in the form of alpha, beta, and gamma radiation. This energy release is governed by Einstein's famous equation,  $E=mc^2$ , where  $E$  represents energy,  $m$  represents mass, and  $c$  represents the speed of light. The equation demonstrates that mass and energy are interchangeable: a small amount of mass can be converted into a tremendous amount of energy.

**III. Can we calculate "plutonium calories"?** While we can't talk about "plutonium calories" in the dietary sense, we can calculate the total energy released by plutonium decay using  $E=mc^2$ . However, this energy is expressed in joules, not calories. To convert joules to calories, we use the conversion factor: 1 calorie = 4.184 joules. Let's consider a hypothetical example: suppose we have 1 gram of plutonium-239, a common isotope. Plutonium-239 undergoes alpha decay, releasing energy over time. The total energy released from the complete decay of 1 gram of Pu-239 is approximately  $7.98 \times 10^{10}$  joules. Converting this to calories, we get roughly  $1.9 \times 10^{10}$  calories. This is an immense amount of energy, far exceeding the caloric content of any food.

**IV. The crucial difference: Usable energy vs. Total energy.** The key distinction is that the energy released from plutonium decay is not "usable" in the same way as food calories. Food calories are

chemically released through metabolic processes, providing energy our bodies can harness. The energy from plutonium decay, however, is in the form of ionizing radiation – highly energetic particles that are incredibly damaging to biological tissues. Ingesting plutonium would not provide energy; it would cause severe radiation sickness, likely leading to death. V. Real-world implications: The immense energy release from plutonium is harnessed in nuclear reactors and nuclear weapons. Nuclear reactors use controlled fission of plutonium (and uranium) to generate heat, which is then used to produce electricity. Nuclear weapons exploit the uncontrolled chain reaction of plutonium fission to release a devastating explosion. In both cases, the energy released is many orders of magnitude greater than what could be obtained from the same mass of food. VI. Takeaway: The concept of "plutonium calories" is a misleading analogy. While plutonium releases a massive amount of energy, this energy is not biologically usable and is incredibly dangerous. The term "calorie" in the context of plutonium is inappropriate and should be avoided. Instead, the energy released by plutonium should be discussed in terms of joules or other suitable units of energy, emphasizing the fundamental difference between nuclear energy and the chemical energy found in food.

Frequently Asked Questions (FAQs):

1. Can any radioactive material be considered to have "calories"? No. While all radioactive materials release energy upon decay, this energy is not in a form usable by biological systems and is often harmful. The term "calories" is reserved for describing usable chemical energy.
2. How does the energy released by plutonium compare to the energy content of a typical meal? The energy released by a gram of plutonium is many billions of times greater than the energy contained in a typical meal (several thousand calories).
3. What are the health risks associated with plutonium ingestion? Ingesting plutonium is extremely dangerous, leading to acute radiation sickness, organ damage, and potentially death. The radiation damages DNA and disrupts cellular functions.
4. Is there any way to harness the energy of plutonium safely for energy production? Yes, nuclear reactors use controlled fission of plutonium (and uranium) to generate electricity. However, this process requires extremely sophisticated safety measures to prevent accidents and contain radioactive waste.
5. What is the difference between fission and fusion in the context of energy production? Fission is the splitting of a heavy atomic nucleus (like plutonium or uranium) into smaller nuclei, releasing energy. Fusion is the combining of light atomic nuclei (like hydrogen isotopes) into heavier nuclei, also releasing energy. Fusion typically releases even more energy than fission but is currently more challenging to control for power generation.

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