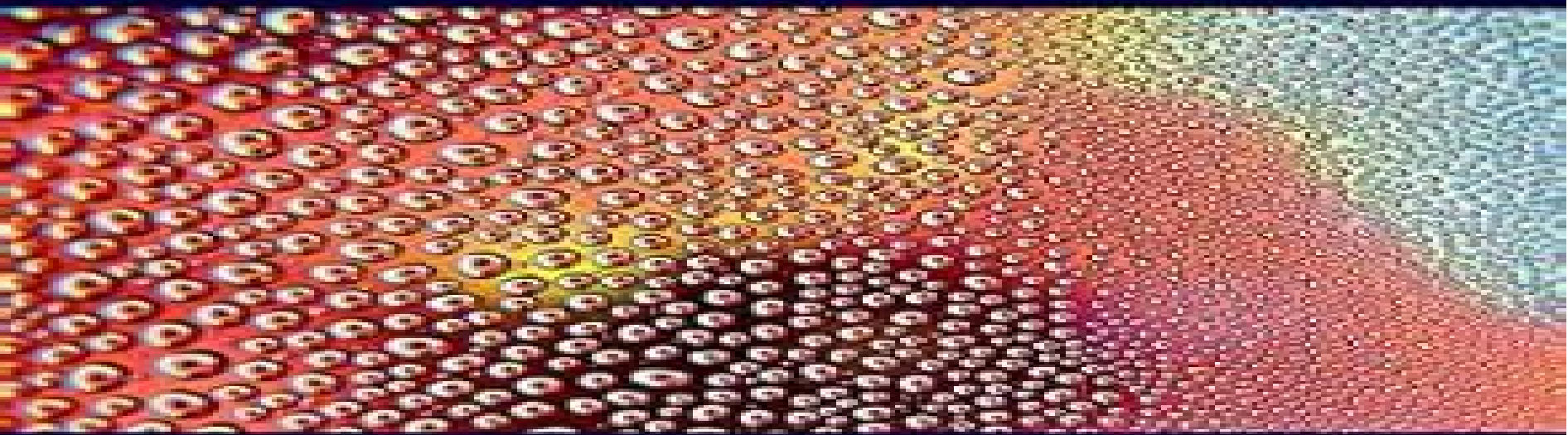


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Flows and Chemical Reactions in Heterogeneous Mixtures

Roger Prud'homme



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Flows and Chemical Reactions in Homogeneous Mixtures Roger Prud'homme, 2013-10-08 Flows with chemical reactions can occur in various fields such as combustion process engineering aeronautics the atmospheric environment and aquatics The examples of application chosen in this book mainly concern homogeneous reactive mixtures that can occur in propellers within the fields of process engineering and combustion propagation of sound and monodimensional flows in nozzles which may include disequilibria of the internal modes of the energy of molecules ideal chemical reactors stabilization of their steady operation points in the homogeneous case of a perfect mixture and classical instruments of experimental and theoretical analysis such as population balances and the distribution of residence and passage times laminar and turbulent flames separating those which are premixed from those which are not and which do not exhibit the same mechanisms but which also occur in the case of triple flames *Flows and Chemical Reactions in Homogeneous Mixtures* provides information on dimensional analysis statistical thermodynamics with coupling between internal modes and chemical reactions the apparition and damping of fluid turbulence as well as its statistical processing bifurcations flames in a confined medium and diffusion Contents 1 Flows in Nozzles 2 Chemical Reactors 3 Laminar and Turbulent Flames Appendix 1 Dimensionless Numbers Similarity Appendix 2 Thermodynamic Functions Appendix 3 Concepts of Turbulence Appendix 4 Thermodynamic functions for a mixture in disequilibrium Appendix 5 Notion of bifurcation Appendix 6 Confined flame Appendix 7 Limits of Validity of the First order Expansions for Diffusion Flames

Flows and Chemical Reactions in an Electromagnetic Field Roger Prud'homme, 2014-10-30 This book a sequel of previous publications *Flows and Chemical Reactions* *Chemical Reactions* *Flows in Homogeneous Mixtures* and *Chemical Reactions and Flows in Heterogeneous Mixtures* is devoted to flows with chemical reactions in the electromagnetic field The first part entitled basic equations consists of four chapters The first chapter provides an overview of the equations of electromagnetism in Minkowski spacetime This presentation is extended to balance equations first in homogeneous media unpolarized in the second chapter and homogeneous fluid medium polarized in the third chapter Chapter four is devoted to heterogeneous media in the

presence of electromagnetic field Balance equations at interfaces therein The second part of this volume is entitled applications It also includes four chapters Chapter five provides a study of the action of fields on fire Chapter six deals with a typical application for the Peltier effect chapter seven is devoted to metal plasma interaction especially in the Langmuir probe and finally Chapter Eight deals with the propulsion Hall effect Are given in appendix supplements the laws of balance with electromagnetic field and described the methodology for establishing one dimensional equations for flow comprising active walls as is the case in some Hall effect thrusters

Fluid Mechanics at Interfaces 3 Roger Prud'homme, Stephane Vincent, 2025-07-24 Interfaces are present in most fluid mechanics problems They not only denote phase separations and boundary conditions but also thin flames and discontinuity waves Fluid Mechanics at Interfaces 3 firstly positions models as relative to applications i e pollution drops for propulsion wind power etc then emphasizes the importance of social consequences Chapter 1 examines the questions raised by simulation of a pollutant s concentration degradation in permanent 2D flow using the finite element method Chapter 2 considers an approximate analytical solution for mixed injection regimes which acts on drop vaporization frequency response Chapter 3 examines the case of an incompressible external flow of uniform speed at infinity leading the liquid in the drop by friction Chapter 4 gives a summary of combustion based weapons and their effects Chapter 5 then looks at the shifting interface in spacetime Chapter 6 limits itself to two key concepts the first is that of capillary interfaces where surface tension is present even at equilibrium the second is that of thin flames which only exist outside of equilibrium but which can be considered as generalized interfaces Chapter 7 challenges the idea of constituents of matter leading to radically transforming chemistry Chapter 8 is concerned by the modeling of partial wetting by macroscopic approach in discrete mechanics Chapter 9 states a numerical method of finite differences making it possible to calculate the variables describing an average flow Chapter 10 considers circulation in the vessels of the human body Chapter 11 contributes by generalizing the classical series solution for initial boundary value problems of the 1D reaction diffusion equations on any finite interval of the real line

Fluid Mechanics at Interfaces 1 Roger Prudhomme, Stephane Vincent, 2022-04-05 Interfaces are present in most fluid mechanics problems They not only denote phase separations and boundary conditions but also thin flames and discontinuity waves Fluid Mechanics at Interfaces 1 focuses on the science of interfaces in particular using various scientific methods of analysis relating to space speed and time Our investigation takes us from the microscopic or small scale starting with molecular and nanoscopic scales to the macroscopic including meso and interstellar scales and also explores the laws of interfaces classical mechanics quantum mechanics and relativistic mechanics Chapter 1 examines the questions raised by modeling interfaces in the presence of one or more fluid phases Chapter 2 discusses the action of turbulence in liquid vapor flows that contain both small dispersed bubbles as well as large bubbles with heat exchanges at the interfaces In addition a new model is presented using large eddy simulation LES Chapter 3 studies an original method for calculating the drag force and thermal transfers in flows around

networks of spherical particles while Chapter 4 focuses on the relationships between interfaces and critical fluids Chapter 5 examines shearing which causes anomalies in the Brownian motion of particles in strongly fluctuating near critical mixtures and Chapter 6 introduces basic concepts related to combustion interfaces raising the question of the combustion of solids before ending with a brief presentation of the Rankine Hugoniot theory and a historical overview of the research carried out in the field of combustion

Fluid Mechanics at Interfaces 2 Roger Prudhomme, Stephane Vincent, 2022-03-04 Interfaces are present in most fluid mechanics problems They not only denote phase separations and boundary conditions but also thin flames and discontinuity waves Fluid Mechanics at Interfaces 2 examines cases that involve one dimensional or bi dimensional manifolds not only in gaseous and liquid physical states but also in subcritical fluids and in single and multi phase systems that may be pure or mixed Chapter 1 addresses certain aspects of turbulence in discrete mechanics briefly describing the physical model associated with discrete primal and dual geometric topologies before focusing on channel flow simulations at turbulence inducing Reynolds numbers Chapter 2 centers on atomization in an accelerating domain In one case an initial Kelvin Helmholtz instability generates an acceleration field in turn creating a Rayleigh Taylor instability which ultimately determines the size of the droplets formed Chapter 3 explores numerical studies of pipes with sudden contraction using OpenFOAM and focuses on modeling that will be useful for engines and automobiles Chapters 4 and 5 study the evaporation of droplets that are subject to high frequency perturbations a possible cause of instabilities in injection engines The Heidmann model which replaces the droplets in motion in a combustion chamber with a single continuously fed droplet is made more complex by considering the finite conduction heat transfer phenomenon Finally Chapter 6 is devoted to a study of the rotor blade surface of a Savonius wind turbine considering both a non stationary and a three dimensional flow

Dimensional Analysis and Similarity in Fluid Mechanics Nord-Eddine Sad Chemloul, 2020-11-03 Dimensional analysis is the basis for the determination of laws that allow the experimental results obtained on a model to be transposed to the fluid system at full scale a prototype The similarity in fluid mechanics then allows for better redefinition of the analysis by removing dimensionless elements This book deals with these two tools with a focus on the Rayleigh method and the Vaschy Buckingham method It deals with the homogeneity of the equations and the conversion between the systems of units SI and CGS and presents the dimensional analysis approach before addressing the similarity of flows Dimensional Analysis and Similarity in Fluid Mechanics proposes a scale model and presents numerous exercises combining these two methods It is accessible to students from their first year of a bachelors degree

Discrete Mechanics Jean-Paul Caltagirone, 2019-01-24 The discrete vision of mechanics is based on the founding ideas of Galileo and the principles of relativity and equivalence which postulate the equality between gravitational mass and inertial mass To these principles are added the Hodge Helmholtz decomposition the principle of accumulation of constraints and the hypothesis of the duality of physical actions These principles make it possible to establish the equation of motion based on the conservation of acceleration considered as

an absolute quantity in a local frame of reference in the form of a sum of the gradient of the scalar potential and the curl of the vector potential These potentials which represent the constraints of compression and rotation are updated from the discrete operators Discrete Mechanics Concepts and Applications shows that this equation of discrete motion is representative of the compressible or incompressible flows of viscous or perfect fluids the state of stress in an elastic solid or complex fluid and the propagation of nonlinear waves

Wall Turbulence Control Sedat Tardu, 2017-02-08 Wall turbulence control is a major subject the investigation of which involves significant industrial environmental and fundamental consequences Wall Turbulence Control addresses recent advances achieved in active and passive wall turbulence control over the past two decades This valuable reference for scientists researchers and engineers provides an updated view of the research into this topic including passive control optimal and suboptimal control methodology linear control and control using adaptive methods neural networks polymer and bubble injection electromagnetic control and recent advances in control by plasma

Scientific and Technical Aerospace Reports, 1965 Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database

Chemical Engineering Essentials, Volume 2 Raj K. Arya, George D. Verros, J. Paulo Davim, 2025-05-13 In an era of rapid innovation and with a focus on sustainability Chemical Engineering Essentials provides a definitive guide to mastering the discipline Divided into two volumes this series offers a seamless blend of foundational knowledge and advanced applications to address the evolving needs of academia and industry Volume 1 lays a strong foundation with topics such as material and energy balances thermodynamics phase equilibrium fluid mechanics transport phenomena and essential separation processes such as distillation and membrane technologies This volume builds on these principles delving into reaction engineering reactor modeling with MATLAB and ASPEN PLUS material properties process intensification and nanotechnology It also addresses critical global challenges emphasizing green chemistry waste minimization resource recovery and workplace safety Together these volumes provide a holistic understanding of chemical engineering equipping readers with the tools to innovate and lead in a dynamic and sustainable future

[The First Steps of Life](#) Ernesto Di Mauro, 2024-02-28 Origin of Life studies have a nearly impossible goal understanding nature through the comprehension of its origins and its complexities As a growing field with poorly defined borders Origin of Life studies profit from progress in other disciplines This book proposes both an overview of this large area and an in depth look at the opinions and results obtained by some of the active contributors of this fascinating and deeply thought provoking matter The topics are presented in a bottom up order first touching on the habitability of the universe then the rationale behind meaningful prebiotic chemistry the possible or probable prebiotic chemical frames the problem of chirality and moving on through the role of minerals in biogenesis biogenic fertile environments the in and out problem as solved by vesicles physics the evolution of the codes the structure of LUCA and its proto metabolisms and the meaning of complex extant biological biomorphs as

exemplified by viroids These topics and the reasoning within the chapters are provided against the backdrop of the evolution of information and complexity

Bioreactor Modeling Jerome Morchain, 2017-10-06 Dynamic simulation of bioreactors is a challenge for both the industrial and academic worlds Beyond the large number of physical and biological phenomena to be considered and the wide range of scales involved the central difficulty lies in the need to account for the dynamic behavior of suspended microorganisms In the case of chemical reactors knowledge of the thermodynamic equilibrium laws at the interfaces makes it possible to produce macroscopic models by integrating local laws Microorganisms on the other hand have the ability to modulate the rate of substrate assimilation Moreover the nature of the biochemical transformations results from a compromise between the needs of the cell and the available resources This book revisits the modeling of bioreactors using a multi scale approach It addresses issues related to mixing phase to phase transfers and the adaptation of microorganisms to variations in concentration and explores the use of population balances for the simulation of bioreactors By adopting a multidisciplinary perspective that draws on process engineering fluid mechanics and microbiology this book sheds new light on the particularity of bioprocesses in relation to physical and chemical phenomena Presents a multiphase description of bioreactor modeling Includes a combination of concepts issued from different scientific fields to address a practical issue Provides a detailed description of the population balance concept as applied to biological systems Covers a set of illustrative examples of the interaction between hydrodynamics and biological response

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ERDA Energy Research Abstracts United States. Energy Research and Development Administration, 1976

Government Reports Announcements & Index, 1990

Flows and Chemical Reactions Roger Prud'homme, 2013-01-09 The aim of this book is to relate fluid flows to chemical reactions It focuses on the establishment of consistent systems of equations with their boundary conditions and interfaces which allow us to model and deal with complex situations Chapter 1 is devoted to simple fluids i e to a single chemical constituent The basic principles of incompressible and compressible fluid mechanics are presented in the most concise and educational manner possible for perfect or dissipative fluids Chapter 2 relates to the flows of fluid mixtures in the presence of chemical reactions Chapter 3 is concerned with interfaces and lines Interfaces have been

the subject of numerous publications and books for nearly half a century Lines and curvilinear media are less known Several appendices on mathematical notation thermodynamics and mechanics methods are grouped together in Chapter 4 This summary presentation of the basic equations of simple fluids with exercises and their solutions as well as those of chemically reacting flows and interfaces and lines will be very useful for graduate students engineers teachers and scientific researchers in many domains of science and industry who wish to investigate problems of reactive flows Portions of the text may be used in courses or seminars on fluid mechanics

Fast Chemical Reactions in Turbulent Flows Rustam Ya Deberdeev, 2013-09-02 This book describes the fundamentals of fast liquid phase chemical reactions and the principles of their scientific foundation technical implementation and industrial application of new technologies In addition the equipment required to perform these reactions in a turbulent mode in the chemical petrochemical and petroleum industries is also discussed The macrokinetic approach has been developed with consideration of the diffusion hydrodynamics and heat transfer processes Due to the advancement of fundamental knowledge equations of practical engineering importance have been obtained for the calculations of mass and heat transfer processes carried out in conditions of high turbulence and developed for the implementation in fast chemical reactions involving the synthesis of low molecular weight products and polymers New methods for controlling the molecular characteristics of polymers have been developed based on the tailored regulation of the hydrodynamics of the reactive mixture flow Typical processes have been used as model examples to reveal the influence of turbulence on the behaviour of fast chemical reactions used for the synthesis of low molecular weight products in single phase and two phase reactive systems Brand new tubular devices have been developed with the following characteristics compact size high productivity and a quasi perfect mixing operation mode in turbulent flows These devices are subdivided into cylindrical shell and tube zone and diffuser confuser designs Original solutions are proposed for the instrumental implementation of fast liquid phase processes and development of continuous energy and resource efficient technologies for the synthesis of some large scale compounds

A Partial-dissipation Approximation for Chemical Reactions in Heterogeneous Turbulent Flows Shao-Chi Lin, 1964

Two Phase Flows in Chemical Engineering David Azbel, 1981-08-31 The behaviour of bubbles is a unifying theme of this book From an explanation of the fundamentals of bubbles formation at a single orifice Dr Azbel goes on to set up equations for bubble motion bubble size bubble size distribution and pressure drop across a perforated plate

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