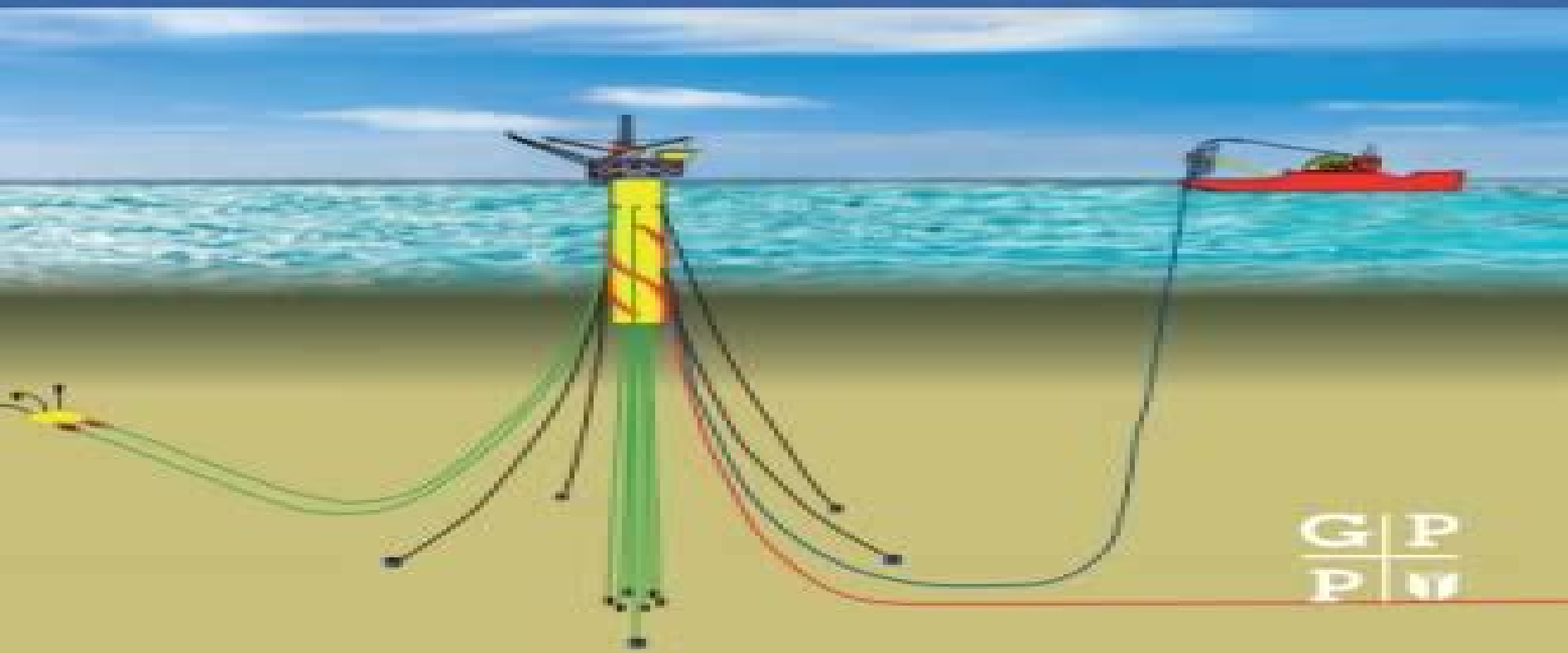


Second Edition

STELIOS KYRIAKIDES AND EDMUNDO CORONA

# MECHANICS OF OFFSHORE PIPELINES

VOLUME 1: BUCKLING AND COLLAPSE



# Mechanics Of Offshore Pipelines Volume Buckling And Collapse

**Ted G. Byrom**



## **Mechanics Of Offshore Pipelines Volume Buckling And Collapse:**

*Mechanics of Offshore Pipelines* Stelios Kyriakides,Edmundo Corona,2007-07-26 Offshore oil and gas production was conducted throughout the entire 20th century but the industry's modern importance and vibrancy did not start until the early 1970s when the North Sea became a major producer Since then the expansion of the offshore oil industry has been continuous and rapid Pipelines and more generally long tubular structures are major oil and gas industry tools used in exploration drilling production and transmission Installing and operating tubular structures in deep waters places unique demands on them Technical challenges within the field have spawned significant research and development efforts in a broad range of areas Volume I addresses problems of buckling and collapse of long inelastic cylinders under various loads encountered in the offshore arena Several of the solutions are also directly applicable to land pipelines The approach of *Mechanics of Offshore Pipelines* is problem oriented The background of each problem and scenario are first outlined and each discussion finishes with design recommendations New and classical problems addressed investigated through a combination of experiments and analysis Each chapter deals with a specific mechanical problem that is analyzed independently The fundamental nature of the problems makes them also applicable to other fields including tubular components in nuclear reactors and power plants aerospace structures automotive and civil engineering structures naval vehicles and structures

**Mechanics of Offshore Pipelines: Volume I** Stelios Kyriakides,Edmundo Corona,2023-01-11 *Mechanics of Offshore Pipelines* Second Edition Volume One Buckling and Collapse gives engineers fundamental knowledge on principles surrounding the mechanical behavior of pipelines and long tubular structures in the oil and gas industry Addressing common challenges pertaining to buckling and collapse under various offshore loads the authors go through each challenge experimentally with supporting and analyzing data to present the main limits encountered Helpful to both the practicing engineer and the graduate level the combined effort of analysis supplemented with numerical modeling helps engineers design procedures and guidelines to reproduce the best solution or solve problems using a nonlinear finite element code Custom formulations are also included to help users gain a deeper understanding of each challenge Rounding out with helpful appendices including a glossary of terms this book continues to deliver critical research and data to engineers that need to design install and maintain efficient and safe offshore pipelines Updated to include more practical aspects such as failure of corroded pipes under external pressure and response of bi material under bending Delves into cost effective materials and installation techniques Covers guidelines practicing methods and recommendations on maintenance and design Recommended as the bible for offshore pipelines Explains the full spectrum of classical challenges such as inelastic structural mechanics and the newest technological demands

*Mechanics of Offshore Pipelines, Volume 2* Stelios Kyriakides,Liang-Hai Lee,2020-09-21 Buckle propagation is a problem unique to offshore pipelines in which the local collapse of a locally weakened section of the pipe initiates a collapse that propagates at high speed catastrophically flattening the line

by kilometers The lowest pressure that can sustain the propagation of the collapse the propagation pressure is only a small fraction of the collapse pressure of the intact pipe The large difference between these two pressures requires that pipelines be designed on the collapse pressure and the extent of the potential catastrophic damage suffered is limited by the periodic introduction of buckle arrestors to the line Volume 2 of the book series Mechanics of Offshore Pipelines addresses the major aspects of buckle propagation including its initiation establishment of the propagation pressure and the dynamics of buckle propagation Buckle propagation under tension in pipe in pipe pipeline systems and confined buckle propagation in tubulars such as grouted casing are examined in dedicated chapters Three chapters deal with the performance of the most commonly used buckle arrestors under both quasi static and dynamic buckle propagation Each of these problems is studied through experiments analyses and large scale numerical simulations The results are used to provide empirical design equations and design guidelines on how to mitigate the effects of buckle propagation Buckle propagation and arrest approached from both fundamental and applied points of view Provides data empirical design formulae and design guidelines Teaches how to analyze buckle propagation and mitigate its effects through experiment and modeling Based on the 40 year research and practice of the most eminent researcher in the subject

**Finite Element Analysis of the Collapse and Post-Collapse Behavior of Steel Pipes: Applications to the Oil Industry** Eduardo N Dvorkin, Rita G. Toscano, 2014-07-08 This book presents a detailed discussion of the models that were developed to simulate the collapse and post collapse behavior of steel pipes The finite element method offers to engineers the possibility of developing models to simulate the collapse behavior of casings inside oil wells and the collapse behavior of deepwater pipelines However if technological decisions are going to be reached from these model results with implications for the economic success of industrial operations for the occupational safety and health and for the environment the engineering models need to be highly reliable Using these models engineers can quantify the effect of manufacturing tolerances wear corrosion etc This book describes in great details the experimental programs that are developed to validate the numerical results

**Structural Mechanics and Design of Metal Pipes** Spyros A. A. Karamanos, 2022-12-07 Structural Mechanics and Design of Metal Pipes A systematic approach for onshore and offshore pipelines presents a unified and systematic approach to understanding and analyzing the structural behavior of onshore and offshore metallic pipelines Following an overview of pipeline engineering and pipe fabrication the mechanics of elastic rings and cylinders is presented as a prelude to structural performance of metal pipes under various loading conditions which involve pressure and structural loads The book also discusses special topics such as geohazards and strain based design large diameter water pipelines global buckling and mechanically lined pipes and outlines approaches for developing state of the art finite element models In all topics addressed in this book the mechanical behavior of pipes is related with specific design methods for onshore and offshore pipelines Reflects the author's 30 year experience in structural mechanics of pipes and tubulars Describes the structural performance of onshore and offshore pipelines Addresses key

features of pipe mechanics to both practicing engineers and researchers Covers a wide spectrum of pipe behavior from the pipe mill to service conditions Presents the background of structural design provisions in major pipeline standards

**Subsea Pipeline Design, Analysis, and Installation** Qiang Bai,Yong Bai,2014-02-18 As deepwater wells are drilled to greater depths pipeline engineers and designers are confronted with new problems such as water depth weather conditions ocean currents equipment reliability and well accessibility Subsea Pipeline Design Analysis and Installation is based on the authors 30 years of experience in offshore The authors provide rigorous coverage of the entire spectrum of subjects in the discipline from pipe installation and routing selection and planning to design construction and installation of pipelines in some of the harshest underwater environments around the world All inclusive this must have handbook covers the latest breakthroughs in subjects such as corrosion prevention pipeline inspection and welding while offering an easy to understand guide to new design codes currently followed in the United States United Kingdom Norway and other countries Gain expert coverage of international design codes Understand how to design pipelines and risers for today s deepwater oil and gas Master critical equipment such as subsea control systems and pressure piping *Oil and Gas Pipelines* R. Winston Revie,2015-04-20 A comprehensive and detailed reference guide on the integrity and safety of oil and gas pipelines both onshore and offshore Covers a wide variety of topics including design pipe manufacture pipeline welding human factors residual stresses mechanical damage fracture and corrosion protection inspection and monitoring pipeline cleaning direct assessment repair risk management and abandonment Links modern and vintage practices to help integrity engineers better understand their system and apply up to date technology to older infrastructure Includes case histories with examples of solutions to complex problems related to pipeline integrity Includes chapters on stress based and strain based design the latter being a novel type of design that has only recently been investigated by designer firms and regulators Provides information to help those who are responsible to establish procedures for ensuring pipeline integrity and safety **Beam Theory for Subsea Pipelines** Alexander N. Papusha,2015-08-06 Introducing a new practical approach within the field of applied mechanics developed to solve beam strength and bending problems using classical beam theory and beam modeling this outstanding new volume offers the engineer scientist or student a revolutionary new approach to subsea pipeline design Integrating use of the Mathematica program into these models and designs the engineer can utilize this unique approach to build stronger more efficient and less costly subsea pipelines a very important phase of the world s energy infrastructure Significant advances have been achieved in implementation of the applied beam theory in various engineering design technologies over the last few decades and the implementation of this theory also takes an important place within the practical area of re qualification and reassessment for onshore and offshore pipeline engineering A general strategy of applying beam theory into the design procedure of subsea pipelines has been developed and already incorporated into the ISO guidelines for reliability based limit state design of pipelines This work is founded on these significant advances The

intention of the book is to provide the theory research and practical applications that can be used for educational purposes by personnel working in offshore pipeline integrity and engineering students A must have for the veteran engineer and student alike this volume is an important new advancement in the energy industry a strong link in the chain of the world s energy production *Handbook of Pipeline Engineering* ABCM - Brazilian Society of Mechanical Sciences and Engineering, José Luiz de França Freire, Marcelo Rosa Rennó Gomes, Marcelino Guedes Gomes, 2024-07-25 This Handbook covers a large number of Pipeline Engineering topics ranging from the initial stages of designing constructing operating and managing the integrity of a pipeline to several of their fluid transportation applications such as oil gas derivatives slurry hydrogen and CO<sub>2</sub> Traditional onshore and offshore pipelines are covered as well as chapters on present and future interaction with modern society This Handbook serves as a first reference resource for new readers entering the field but also as a complement to those who are aware of the general principles encompassing areas of pipeline engineering This Handbook has been developed in close cooperation with ABCM the Brazilian Society of Mechanical Sciences and Engineering

Flexible Pipelines and Power Cables Yong Bai, Shuai Yuan, Kaien Jiang, 2024-05-15 FLEXIBLE PIPELINES AND POWER CABLES Pipelines are an important part of the world s energy infrastructure and without them oil and gas the most commonly used sources for energy today would not be available to much of the world s countries New theories and designs are constantly being researched and developed by scientists and engineers to continue improving this technology and making it safer and more economical The technology processes materials and theories surrounding pipeline construction application and troubleshooting are constantly changing and this groundbreaking series *Advances in Pipes and Pipelines* has been created to meet the needs of engineers and scientists to keep them up to date and informed of all of these advances This latest volume in the series focuses on flexible pipelines and power cables offering the engineer the most thorough coverage of the state of the art available The authors of this work have written numerous books and papers on these subjects and are some of the most influential authors on flexible pipes in the world contributing much of the literature on this subject to the industry This new volume is a presentation of some of the most cutting edge technological advances in technical publishing This is the most comprehensive and in depth series on pipelines covering not just the various materials and their aspects that make them different but every process that goes into their installation operation and design This is the future of pipelines and it is an important breakthrough A must have for the veteran engineer and student alike this volume is an important new advancement in the energy industry a strong link in the chain of the world s energy production **Non-Classical Problems in the Theory of Elastic Stability** Isaac Elishakoff, Yiwei Li, James H. Starnes, 2001-01-29 When a structure is put under an increasing compressive load it becomes unstable and buckling occurs Buckling is a particularly significant concern in designing shell structures such as aircraft automobiles ships or bridges This book discusses stability analysis and buckling problems and offers practical tools for dealing with uncertainties that exist in real systems The techniques are based on two

complementary theories which are developed in the text First the probabilistic theory of stability is presented with particular emphasis on reliability Both theoretical and computational issues are discussed Secondly the authors present the alternative to probability based on the notion of anti optimization a theory that is valid when the necessary information for probabilistic analysis is absent that is when only scant data are available Design engineers researchers and graduate students in aerospace mechanical marine and civil engineering who are concerned with issues of structural integrity will find this book a useful reference source

**New Innovations in Engineering Education and Naval Engineering** Nur Md. Sayeed Hassan,Sérgio António Neves Lousada,Rafael Freitas Camacho,2020-02-19 This book Naval Engineering comprises information on different interdependent technical aspects important in the development of a ship project in its entirety Part One of this book introduces cutting edge research on the key issues of the latest advances in developing a successful engineering curriculum in designing an innovative learning and teaching method and in promoting consistent standards in engineering education Part Two provides a wider perspective in the area of naval engineering and presents its relevant challenges and new opportunities The chapters included in this book cover the related concepts of technical sustainable and social innovation that have a substantial influence on the society and the stakeholders This book intends to provide a wider perspective for the naval engineering field It presents relevant challenges as well as new opportunities

**Offshore Process Safety** ,2018-06-18 Methods in Chemical Process Safety Volume Two the latest release in a serial that publishes fully commissioned methods papers across the field of process safety risk assessment and management and loss prevention aims to provide informative visual and current content that appeals to both researchers and practitioners in process safety This new release contains unique chapters on offshore safety offshore platform safety human factors in offshore operation marine safety safety during well drilling and operation safety during processing top side safety during transportation of natural resources offshore pipeline and regulatory context Helps acquaint the reader researcher with the fundamentals of process safety Provides the most recent advancements and contributions on the topic from a practical point of view Presents users with the views opinions of experts in each topic Includes a selection of the author s of each chapter from among the leading researchers and or practitioners for each given topic

**Subsea Pipelines and Risers** Yong Bai,Qiang Bai,2005-12-05 Marine pipelines for the transportation of oil and gas have become a safe and reliable part of the expanding infrastructure put in place for the development of the valuable resources below the worlds seas and oceans The design of these pipelines is a relatively new technology and continues to evolve as the design of more cost effective pipelines becomes a priority and applications move into deeper waters and more hostile environments This updated edition of a best selling title provides the reader with a scope and depth of detail related to the design of offshore pipelines and risers not seen before in a textbook format With over 25years experience Professor Yong Bai has been able to assimilate the essence of the applied mechanics aspects of offshore pipeline system design in a form of value to students and designers alike It represents an excellent source

of up to date practices and knowledge to help equip those who wish to be part of the exciting future of this industry

**Exergy, Energy System Analysis and Optimization - Volume II** Christos A. Frangopoulos, 2009-05-13 Exergy Energy System Analysis and Optimization theme is a component of the Encyclopedia of Energy Sciences Engineering and Technology Resources which is part of the global Encyclopedia of Life Support Systems EOLSS an integrated compendium of twenty one Encyclopedias These three volumes are organized into five different topics which represent the main scientific areas of the theme 1 Exergy and Thermodynamic Analysis 2 Thermo-economic Analysis 3 Modeling Simulation and Optimization in Energy Systems 4 Artificial Intelligence and Expert Systems in Energy Systems Analysis 5 Sustainability Considerations in the Modeling of Energy Systems Fundamentals and applications of characteristic methods are presented in these volumes 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 *Fluid-Structure*

*Interactions: Volume 2* Michael P. Paidoussis, 2016-02-05 The second of two volumes concentrating on the dynamics of slender bodies within or containing axial flow Volume 2 covers fluid structure interactions relating to shells cylinders and plates containing or immersed in axial flow as well as slender structures subjected to annular and leakage flows This volume has been thoroughly updated to reference the latest developments in the field with a continued emphasis on the understanding of dynamical behaviour and analytical methods needed to provide long term solutions and validate the latest computational methods and codes with increased coverage of computational techniques and numerical methods particularly for the solution of non linear three dimensional problems Provides an in depth review of an extensive range of fluid structure interaction topics with detailed real world examples and thorough referencing throughout for additional detail Organized by structure and problem type allowing you to dip into the sections that are relevant to the particular problem you are facing with numerous appendices containing the equations relevant to specific problems Supports development of long term solutions by focusing on the fundamentals and mechanisms needed to understand underlying causes and operating conditions under which apparent solutions might not prove effective **Casing and Liners for Drilling and Completion**

Ted G. Byrom, 2014-06-04 Once thought of as niche technology operators today are utilizing more opportunities with casing and liners as formations and environments grow in difficulty especially with the unconventional oil and gas boom Casing and liners for Drilling and Completions 2nd Edition provides the engineer and well designer with up to date information on critical properties mechanics design basics and newest applications for today's type of well Renovated and simplified to cover operational considerations pressure loads and selection steps this handbook gives you the knowledge to execute the essential and fundamental features of casing and liners Bonus features include Additional glossary added to explain oil field terminology New appendix on useful every day formulas such as axial stress shear stress in tubes and principal stress components Listing section of acronyms notations symbols and constants for quick reference Concise step by step basic



casing design procedure with examples Thorough coverage and tips on important field practice for installation topics Advanced methods for critical and horizontal well casing design including hydraulic fracturing Exhaustive appendices on foundational topics units nomenclature solid mechanics hydrostatics borehole environment rock mechanics and a summary of useful formulas

*Subsea Rigid Pipelines – Methods of Installation* Eng-Bin Ng, 2019-07-16 This book is about the various methods of installing rigid subsea submarine pipelines such as the common methods using S lay J lay and reel lay vessels Other methods like the surface tow bottom pull and various other pipeline tow methods are also utilized It also addresses supplementary activities required as part of a pipeline installation program such as pipe manufacture and coating seabed intervention riser installation pipeline precommissioning and pipeline repairs This book was written for students and newcomers to the oil and gas industry who have little or no knowledge of pipeline construction Unlike other technical books on pipelines this one does not address the detailed design of pipelines Instead it provides an overview of construction methodologies for subsea pipelines As such this book will provide the readers with a different perspective by providing a practical and illustrative approach to explain and illustrate how subsea pipelines can be installed through various methods The author has used examples from some of his past projects Where available he also highlighted the various aspects of the work and in some cases he has provided the lessons that he learned from his past experiences so that readers may learn from the author's experiences too

*Structural and Thermal Analyses of Deepwater Pipes* Chen An, Menglan Duan, Segen F. Estefen, Jian Su, 2020-10-28 This book focuses on advanced methods for the structural and thermal analysis of deepwater pipelines and risers It discusses the limit strength of sandwich pipes including finite element analysis using Python scripts collapse of sandwich pipes with cementitious polymer composites buckle propagation of sandwich pipes dynamic behavior of subsea pipes flow induced vibration of functionally graded pipes two phase flow induced vibration of pipelines vortex induced vibration of free spanning pipelines and the thermal analysis of composites pipes with passive insulation active heating and phase change material layers It also explores structural analysis using finite element analysis and the integral transform technique for fluid structure interaction Lastly the use of lumped parameter formulations combined with finite differences for the thermal analysis of pipelines is examined

**Flexible Pipes** Qiang Bai, Yong Bai, Weidong Ruan, 2017-04-19 Written by one of the most well respected teams of scientists in the area of pipelines this revolutionary approach offers the engineer working in the energy industry the theory analysis and practical applications for applying new materials and modeling to the design and effective use of flexible pipes Recent changes in the codes for building pipelines has led to a boom in the production of new materials that can be used in flexible pipes With the use of polymers steel and other new materials and variations on existing materials the construction and therefore the installation and operation of flexible pipes is changing and being improved upon all over the world The authors of this work have written numerous books and papers on these subjects and are some of the most influential authors on flexible pipes in the world contributing much of the literature on this subject

to the industry This new volume is a presentation of some of the most cutting edge technological advances in technical publishing This is the most comprehensive and in depth book on this subject covering not just the various materials and their aspects that make them different but every process that goes into their installation operation and design The thirty six chapters divided up into four different parts have had not just the authors of this text but literally dozens of other engineers who are some of the world s leading scientists in this area contribute to the work This is the future of pipelines and it is an important breakthrough A must have for the veteran engineer and student alike this volume is an important new advancement in the energy industry a strong link in the chain of the world s energy production

## Unveiling the Magic of Words: A Review of "**Mechanics Of Offshore Pipelines Volume Buckling And Collapse**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their ability to kindle emotions, provoke contemplation, and ignite transformative change is truly awe-inspiring. Enter the realm of "**Mechanics Of Offshore Pipelines Volume Buckling And Collapse**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound effect on the souls of its readers.

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