



# Subsea Pipelines And Risers

**Qiang Bai, Yong Bai**



## **Subsea Pipelines And Risers:**

**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 world's 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 25 years 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.

**Subsea Pipelines and Risers** Yong Bai, Qiang Bai, 2005-12-05 Updated edition of a best-selling title. Author brings 25 years experience to the work. Addresses the key issues of economy and environment. Marine pipelines for the transportation of oil and gas have become a safe and reliable way to exploit the valuable resources below the world's seas and oceans. The design of these pipelines is a relatively new technology and continues to evolve in its quest to reduce costs and minimise the effect on the environment. With over 25 years 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.

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.

**Rules for Subsea Pipelines and Risers** Germanischer Lloyd Aktiengesellschaft, 2004

Deepwater Flexible Risers and Pipelines Yong Bai, 2021-02-03 The technology, processes, materials, and theories surrounding pipeline construction, application, and troubleshooting are constantly changing, and this new 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 second volume in the series focuses on flexible pipelines risers and umbilicals 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 The first volume in this series published by Wiley Scrivener is Flexible Pipes available at [www.wiley.com](http://www.wiley.com) Laying the foundation for the series it is a groundbreaking work written by some of the world's foremost authorities on pipes and pipelines Continuing in this series the editors have compiled the second volume equally as groundbreaking expanding the scope to pipelines risers and umbilicals 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 *Pipelines and Risers* Yong Bai, 2001 The preparation of this book was motivated by recent developments in research and engineering and new design codes It aims to educate more pipeline engineers and provide materials for on job training on the use of new design codes and guides **Rules for Classification and Construction**, 1995 *Subsea Pipeline Integrity and Risk Management* Yong Bai, Qiang Bai, 2014-02-21

Subsea repairs and inspection are costly for petroleum and pipeline engineers and proper training is needed to focus on ensuring system strength and integrity Subsea Pipeline Integrity and Risk Management is the perfect companion for new engineers who need to be aware of the state of the art techniques This handbook offers a hands on problem solving approach to integrity management leak detection and reliability applications such as risk analysis Wide ranging and easy to use the book is packed with data tables illustrations and calculations with a focus on pipeline corrosion flexible pipes and subsea repair Reliability based models also provide a decision making tool for day to day use Subsea Pipeline Integrity and Risk Management gives the engineer the power and knowledge to protect offshore pipeline investments safely and effectively Includes material selection for linepipe especially selection of standard carbon steel linepipe Covers assessment of various types of corrosion processes and definition of anti corrosion design against internal as well as external corrosion Gives process and flow assurance for pipeline systems including pipeline integrity management

**Offshore Pipelines** Boyun Guo, Shanhong Song Ph.D., Ali Ghalambor, Tian Ran Lin PhD, Jacob Chacko, 2005-04-25 Offshore Pipelines covers the full scope of pipeline development from pipeline designing installing and testing to operating It gathers the authors experiences gained through years of designing installing testing and operating submarine pipelines The aim is to provide engineers and management personnel a guideline to achieve cost effective management in their offshore and deepwater pipeline development and operations The book is organized into three parts Part I presents design practices

used in developing submarine oil and gas pipelines and risers Contents of this part include selection of pipe size coating and insulation Part II provides guidelines for pipeline installations It focuses on controlling bending stresses and pipe stability during laying pipelines Part III deals with problems that occur during pipeline operations Topics covered include pipeline testing and commissioning flow assurance engineering and pigging operations This book is written primarily for new and experienced engineers and management personnel who work on oil and gas pipelines in offshore and deepwater It can also be used as a reference for college students of undergraduate and graduate levels in Ocean Engineering Mechanical Engineering and Petroleum Engineering Pipeline design engineers will learn how to design low cost pipelines allowing long term operability and safety Pipeline operation engineers and management personnel will learn how to operate their pipeline systems in a cost effective manner Deepwater pipelining is a new technology developed in the past ten years and growing quickly

Subsea Engineering Handbook Yong Bai,Qiang Bai,2018-11-15 The offshore industry continues to drive the oil and gas market into deeper drilling depths more advanced subsea systems and cross into multiple disciplines to further technology and equipment Engineers and managers have learned that in order to keep up with the evolving market they must have an all inclusive solution reference Subsea Engineering Handbook Second Edition remains the go to source for everything related to offshore oil and gas engineering Enhanced with new information spanning control systems equipment QRA electric tree structures and manifold designs this reference is still the one product engineers rely on to understand all components of subsea technology Packed with new chapters on subsea processing and boosting equipment as well as coverage on newer valves and actuators this handbook explains subsea challenges and discussions in a well organized manner for both new and veteran engineers to utilize throughout their careers Subsea Engineering Handbook Second Edition remains the critical road map to understand all subsea equipment and technology Gain access to the entire spectrum of subsea engineering including the very latest on equipment safety and flow assurance systems Sharpen your knowledge with new content coverage on subsea valves and actuators multiphase flow loop design tree and manifold design as well as subsea control Practice and learn with new real world test examples and case studies

**Subsea Pipelines** Baiqiao Chen,Carlos Guedes Soares,2024-01-12 A subsea pipeline also known as an offshore pipeline or submarine pipeline is a pipeline that is laid on the seabed or inside a specially constructed trench The use of pipelines represents a reliable mode of transport of oil and gas The prevention of failure scenarios such as improper pressurization localized buckling fatigue failure and instability the limit strength internal external pressure corrosion resistant material selection and stability management is the main concern in the design installation and operation of submarine pipelines Fifteen recent research studies broadly covering the structural design and analysis of subsea pipelines or risers are featured in this reprint The applications of the digital twin in subsea pipelines are highlighted Classic structural topics including collapse strength burst strength tensile performance buckling fatigue and bending are investigated in this reprint using numerical and experimental methods Computational fluid

dynamics CFD simulations and proportional integral derivative PID control of the pipelines and risers are also included

*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

**Numerical Modelling of Pipeline and Riser Seabed Interaction** Xiaoyu Dong, 2020 Subsea risers and pipelines are widely used in offshore industries especially for the production of oil and gas resources Due to complex subsea environment a variety of risks are challenging the operation or serviceability life of subsea pipelines and risers Subsea riser and pipeline seabed interaction are proven to have significant effect on its performance This interaction can be modeled by two main approaches beam spring and continuum approach Beam spring model provided the most efficient and economical way to estimate the response of soil While with more explorations in fields more sophisticated and accurate models are required and thus continuum models are developed to give more details on the soil behavior around the pipe Two challenging topics in pipeline and riser seabed interaction were selected 1 the effect of riser seabed interaction on fatigue life in touchdown zone 2 the effect of trenching backfilling on lateral response of buried pipelines The first one was modelled by beam spring approach and the second one investigated by continuum approach The abstracts of the conducted research works are independently discussed below A 1 Part I Pipeline Seabed Interaction Subsea pipelines are often protected by burying in the subsea trenches to mitigate the effects of the functional and environmental loads Depending on the trenching methodology pre lay or post lay trenching trenching and laying the pipeline may take place at the same time or in a different period of time Using the excavated material for backfilling of the pipeline is a common practice and a cost effective solution Depending on trenching methodology construction strategy and environmental loads

the backfilling material may experience different degrees of remolding resulting in a softer material with a range of shear strengths. The difference between the stiffness of the backfill and native material affects the soil failure mechanisms under the lateral pipeline displacement. The relative displacement between the pipeline and the surrounding soil that may occur due to the ground movements, faults, slope instabilities, ice gouging etc. exerts forces on the pipeline. The amplitude of these forces on the pipeline depends on several parameters including the submerged weight of the mobilized backfilling and native soil, the horizontal component of shearing resistance offered by interacted soil and the suction behind the pipe. And the load displacement curve becomes important in terms of the design of the embedded pipelines. Under different circumstances, trenched pipelines might be displaced at different velocities, could be from millimeters per year to very high, resulting in different drainage conditions including undrained condition, partially drained condition and drained condition. Partially drained condition in pipe-soil interaction has been a very challenging topic since it requires a coupled analysis with the pore fluid pressure to explore the induced excess pore pressure which affects the responses of the pipe, internal soil deformation and also the failure mechanism in the soil. However, most of the published works only explored the undrained condition of soil. These parameters in turn depend on several parameters such as the properties of the backfill and the native soil, trench geometry, burial depth and confining pressure, pipeline roughness, pipeline size, loading rate, drained/undrained soil stress history, the backfill extent of consolidation and the over consolidation ratio (OCR) of native soil. In this thesis, a coupled large deformation finite element (LDFE) model using re-meshing and interpolation technique with small strain (RITSS) was developed to give prediction of the pipeline force-displacement response together with the computation of the induced excess pore pressure within large deformations. This coupled LDFE model was proven to have advantages in modelling pipe-soil interaction under drained and partially drained conditions using the ABAQUS built-in coupled pore fluid pressure method which cannot work with the popular existing LDFE method such as Coupled Eulerian-Lagrangian (CEL) method. And the LDFE model was proved to be a strong tool for comprehensive investigation of the progressive failure mechanisms around the pipeline considering the varying pipeline-backfill-trench interaction effects.

## Part II: Riser-Seabed Interaction

Steel catenary risers (SCR) are popular amongst the riser families because of their lower cost and technical advantages such as applicability in a wider range of sizes and water depths. The survey results obtained by remote operating vehicles (ROV) have proved the complex non-linear seabed response to riser fluctuations in the touchdown zone (TDZ) where SCR penetrates into the seabed and cyclically creates trenches often with several diameters deep. The oscillatory motions of SCR in the touchdown zone result in a complex riser interaction mechanism with surrounding media including fluid and soil. Some of the influential parameters contributing to these non-linear hysteretic interactions are soil stiffness degradation under cyclic loads and riser penetration into the seabed, mobilization of suction force within uplift motions of riser, trench base softening and damping, erosive mechanism by water velocity field around the SCR in TDZ and consequent variation of flow pattern of

displaced water the riser dynamics influenced by internal multi phase flow regimes and also vessel motions velocity and frequencies and vortex induced vibration VIV The existing non linear hysteretic riser seabed interaction models have been verified in wave induced fatigue assessment However the effect of non linear seabed interaction on the riser fatigue under riser vibrations has never been examined In this work the performance of the non linear hysteretic models was investigated in slug induced fatigue damages in touchdown zone which is a key contributor to fatigue damage For this purpose first the nodal and global performance of the most popular models was comprehensively examined and its pros and cons were thus explored Then an advanced and novel model was developed to simulate the riser slugging and slug induced fatigue which has never been done in the past due to extreme complexity This model was incorporated into slug induced fatigue analysis and it was indicated that the model was applicable to these type of analysis with acceptable level of accuracies The research work showed that the slug induced vibrations can combine with the wave induced oscillations and create critical case scenarios Therefore it is critical to consider the combined effects of slugging and wave in riser fatigue analysis and fill the knowledge gap

*Flexible Pipelines and Power Cables* Yong Bai, Shuai Yuan, Kaïen 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

*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 requalification 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 Advances in Subsea Pipeline Engineering and Technology C.P. Ellinas,2012-12-06 Dr C P Ellinas Advanced Mechanics flexible pipelines pipeline design fabrication and installation deepwater applications Advances in North Sea technology over the last few years have been concerned mostly with marginal fields small diameter pipelines and new materials which are well covered in the first three topics Economic development of marginal fields requires processing of oil and gas to take place not at the wellhead but at existing facilities usually some distance away Hydrocarbons are thus often transported at high pressure and temperature in small diameter pipelines which need to be protected through trenching However such operational practice has brought to the fore a problem that in the past was of little concern namely upheaval buckling **Subsea Engineering** Mr. Rohit Manglik,2024-01-02 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels Ships and Offshore Structures XIX Carlos Guedes Soares,Y. Garbatov,2015-09-03 This three volume work presents the proceedings from the 19th International Ship and Offshore Structures Congress held in Cascais Portugal on 7th to 10th September 2015 The International Ship and Offshore Structures Congress ISSC is a forum for the exchange of information by experts undertaking and applying marine structural research The aim of **Offshore Risk Assessment** Jan-Erik Vinnem,2013-03-14 Offshore Risk Assessment is the first book to deal with quantified risk assessment QRA as applied specifically to offshore installations and operations Risk assessment techniques have been used for some years in the offshore oil and gas industry and their use is set to expand increasingly as the industry moves into new areas and faces new challenges in older regions The book starts with a thorough discussion of risk analysis methodology Subsequent chapters are devoted to analytical approaches to escalation escape evacuation and rescue analysis of safety and emergency systems Separate chapters analyze the main hazards of offshore structures Fire explosion collision and falling objects Risk mitigation and control are then discussed followed by an outline of an alternative approach to risk modelling that focuses especially on

the risk of short duration activities Not only does the book describe the state of the art of QRA it also identifies weaknesses and areas that need development Readership Besides being a comprehensive reference for academics and students of marine offshore risk assessment and management the book should also be owned by professionals in the industry contractors suppliers consultants and regulatory authorities

**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

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