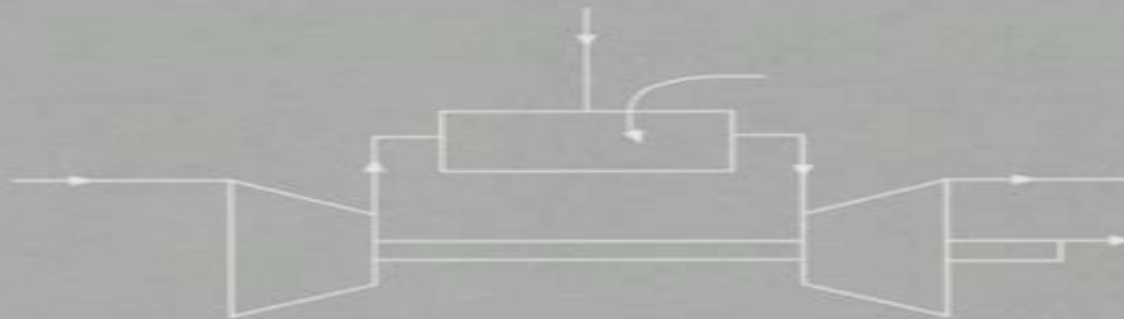


Jan Tommy Gravdahl and Olav Egeland

COMPRESSOR SURGE AND ROTATING STALL

Modeling and Control



Advances in
Industrial Control



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Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control

Rashid M. Ansari, Moses O. Tade



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Compressor Surge and Rotating Stall Jan Tommy Gravdahl, Olav Egeland, 1998-12-01 *Compressor Surge and Rotating Stall* Jan Tommy Gravdahl, Olav Egeland, 2012-12-06 The series *Advances in Industrial Control* aims to report and encourage technology transfer in control engineering The rapid development of control technology impacts all areas of the control discipline New theory new controllers actuators sensors new industrial processes computer methods new applications new philosophies new challenges Much of this development work resides in industrial reports feasibility study papers and the reports of advanced collaborative projects The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination Operating plant as close as possible to constraint boundaries so often brings economic benefits in industrial process control This is the conundrum at the heart of this monograph by Tommy Gravdahl and Olav Egeland on stall control for compressors Operation of the compressor closer to the surge line can increase operational efficiency and flexibility The approach taken by the authors follows the modern control system paradigm physical understanding detailed modelling and simulation studies and finally control studies The thoroughness of the presentation bibliography and appendices indicates that the volume has all the hallmarks of being a classic for its subject Despite the monograph's narrow technical content the techniques and insights presented should appeal to the wider industrial control community as well as the gas turbine compressor specialist M J Grimble and M A

Dissipative Systems Analysis and Control Bernard Brogliato, Rogelio Lozano, Bernhard Maschke, Olav Egeland, 2006-11-24 *Dissipative Systems Analysis and Control* second edition presents a fully revised and expanded treatment of dissipative systems theory constituting a self contained advanced introduction for graduate students researchers and practising engineers It examines linear and nonlinear systems with examples of both in each chapter some infinite dimensional and nonsmooth examples are also included Throughout emphasis is placed on the use of the dissipative properties of a system for the design of stable feedback control laws The theory is consistently substantiated by experimental results and by reference to its application in illustrative physical cases Lagrangian and Hamiltonian systems and adaptive controllers are covered thoroughly The second edition is substantially reorganized both to accommodate new material and to enhance its pedagogical properties *Dissipative Systems Analysis and Control* Rogelio Lozano, Bernard Brogliato, Olav Egeland, Bernhard Maschke, 2013-03-14 This book deals with the analysis and feedback control of dissipative dynamical systems It presents the background of dissipative systems theory Linear as well as nonlinear systems are treated and many examples are given throughout the chapters Some infinite dimensional and non smooth examples are also included The emphasis is put on the application towards the design of stable feedback control laws Then the theory is illustrated on physical examples Lagrangian and Hamiltonian systems are thoroughly studied as well as adaptive control It is shown how the dissipativity properties of a system can be used in the design of stable feedback controllers Some experimental results

are presented which corroborate the theoretical developments This monograph is primarily for readers who wish to get acquainted with Dissipative Systems Theory and its uses in Systems and Control and Robotics It constitutes an advanced introduction to the topic and is the first volume ever published which is dedicated entirely to this subject **Control of Surge in Centrifugal Compressors by Active Magnetic Bearings** Se Young Yoon,Zongli Lin,Paul E. Allaire,2012-06-19 Surge Control of Active magnetic bearing suspended Centrifugal Compressors sets out the fundamentals of integrating active magnetic bearing AMB rotor suspension technology in compressor systems and describes how this relatively new bearing technology can be employed in active control of compressor surge initiation The authors provide a self contained and comprehensive review of rotordynamics and the fundamentals of AMB technology The active stabilization of compressor surge employing AMBs in a machine is fully explored from modeling of instability and controller design to the implementation and experimental testing of the control algorithm in a specially constructed industrial size centrifugal compression system The results of these tests demonstrate the great potential of the new surge control method suggested in this text This book will be useful for engineers in industries that involve turbocompressors and magnetic bearings as well as for researchers and graduate students in the field of applied control Whatever their level of experience engineers working in the fields of turbomachinery magnetic bearings rotordynamics and controls will find the material in this book absorbing as all these important aspects of engineering are integrated to create a multi disciplinary solution to a real life industrial problem and the book is a suitable introduction to the area for newcomers **Advances in Asset Management and Condition**

Monitoring Andrew Ball,Len Gelman,B. K. N. Rao,2020-08-27 This book gathers select contributions from the 32nd International Congress and Exhibition on Condition Monitoring and Diagnostic Engineering Management COMADEM 2019 held at the University of Huddersfield UK in September 2019 and jointly organized by the University of Huddersfield and COMADEM International The aim of the Congress was to promote awareness of the rapidly emerging interdisciplinary areas of condition monitoring and diagnostic engineering management The contents discuss the latest tools and techniques in the multidisciplinary field of performance monitoring root cause failure modes analysis failure diagnosis prognosis and proactive management of industrial systems There is a special focus on digitally enabled asset management and covers several topics such as condition monitoring maintenance structural health monitoring non destructive testing and other allied areas Bringing together expert contributions from academia and industry this book will be a valuable resource for those interested in latest condition monitoring and asset management techniques **Applied Predictive Control** Sunan Huang,Tong Heng

Lee,2013-03-09 The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering The rapid development of control technology has an impact on all areas of the control discipline New theory new controllers actuators sensors new industrial processes computer methods new applications new philosophies new challenges Much of this development work resides in industrial reports feasibility study papers and the reports of advanced

collaborative projects The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination The Advances in Industrial Control series promotes control techniques which are used by industry The series has useful volumes in various aspects of proportional integral derivative PID control because of the widespread use of PID in applications Predictive control is another technique that quickly became essential in some sectors of the petro chemical and process control industries It was the ability of the method to incorporate operational constraints that lead to this take up by industry The wider industrial applications of predictive control has been slower to develop indeed some practitioners might argue that this technology transfer step is still active or had only just begun in some industrial sectors

Bounded Dynamic Stochastic Systems Hong Wang, 2012-12-06 Over the past decades although stochastic system control has been studied intensively within the field of control engineering all the modelling and control strategies developed so far have concentrated on the performance of one or two output properties of the system such as minimum variance control and mean value control The general assumption used in the formulation of modelling and control strategies is that the distribution of the random signals involved is Gaussian In this book a set of new approaches for the control of the output probability density function of stochastic dynamic systems those subjected to any bounded random inputs has been developed In this context the purpose of control system design becomes the selection of a control signal that makes the shape of the system outputs p d f as close as possible to a given distribution The book contains material on the subjects of Control of single input single output and multiple input multiple output stochastic systems Stable adaptive control of stochastic distributions Model reference adaptive control Control of nonlinear dynamic stochastic systems Condition monitoring of bounded stochastic distributions Control algorithm design Singular stochastic systems A new representation of dynamic stochastic systems is produced by using B spline functions to describe the output p d f Advances in Industrial Control aims to report and encourage the transfer of technology in control engineering The rapid development of control technology has an impact on all areas of the control discipline The series offers an opportunity for researchers to present an extended exposition of new work in all aspects of industrial control

Optimisation of Industrial Processes at Supervisory Level Doris A. Saez, Aldo Cipriano, Andrzej W. Ordys, 2012-12-06 In the increasingly competitive modern world the industrial sector faces new challenges such as improving productivity and reducing costs while taking into account the process operational constraints As energy demand increases in many countries especially in big cities where the environmental concerns are very important and resources to produce energy are limited the efficiency of operation of power plants becomes of paramount importance Under this scenario this book presents new methodologies to improve power plants efficiency by using automatic control algorithms This will lead to an improvement in the generation of companies profit and also in the quality of their final product

Advances in PID Control Kok K. Tan, Qing-Guo Wang, Chang C. Hang, 2012-12-06 Recently a great deal of effort has been dedicated to capitalising on advances in mathematical control theory in conjunction with tried

and tested classical control structures particularly with regard to the enhanced robustness and tighter control of modern PID controllers Much of the research in this field and that of the operational autonomy of PID controllers has already been translated into useful new functions for industrial controllers This book covers the important knowledge relating to the background application and design of and advances in PID controllers in a unified and comprehensive treatment including Evolution and components of PID controllers Classical and Modern PID controller design Automatic Tuning Multi loop Control Practical issues concerned with PID control The book is intended to be useful to a wide spectrum of readers interested in PID control ranging from practising technicians and engineers to graduate and undergraduate students

Precision Motion Control Kok K. Tan, Tong H. Lee, Huifang Dou, Sunan Huang, 2013-04-17 Precision manufacturing is a development that has been gathering momentum over the last century and accelerating over the last 25 years in terms of research development and application to product innovation The driving force in this development arises from requirements for much higher performance of products higher reliability longer life lower cost and miniaturization This development is widely known as precision engineering and today it is generally defined as manufacturing to tolerances which are better than one part in 10⁵ Applications are abound and can be found in various semiconductor processes e g lithography wafer probing inspection Coordinate Measuring Machines CMMs and precision metrology systems e g Scanning Probe Microscopy SPM and robot machine tools to carry out micro assembly e g MEMS and delicate short wavelength laser processes As an enabling technology for precision engineering precision instrumentation and measurement geometrical calibration and compensation and motion control are directly important issues to be addressed in the overall system design and realization This book is focused on these aspects of precision engineering It is a compilation of the major results and publications from a major project which develop a state of the art high speed ultra precision robotic system A comprehensive and thorough treatment of the subject matter is provided in a manner that is amenable to a broad base of readers ranging from the academics to the practitioners by providing detailed experimental verifications of the developed materials *Digital Controller*

Implementation and Fragility Robert Istepanian, James F. Whidborne, 2012-12-06 In the usual process of control system design the assumption is made that the controller is implemented exactly This assumption is usually reasonable since clearly the plant uncertainty is the most significant source of uncertainty in the control system while controllers are implemented with high precision hardware However inevitably there will be some amount of uncertainty in the controller a fact that is largely ignored in existing modern advanced robust control techniques If the controller is implemented by analogue means there are some tolerances in the analogue components More commonly the controller will be implemented digitally and consequently there will be uncertainty involved with the quantization in the analogue digital conversion and rounding in the parameter representation and in the numerical computations A failure to account for these uncertainties in the controller may result in a controller that is fragile A controller is fragile in the sense that very small perturbations in the coefficients of

the designed controller destabilize the closed loop control system This book collects a number of articles which consider the problems of finite precision computing in digital controllers and filters Written by leading researchers topics that the book covers include analysis of fragility and finite precision effects design of optimal controller realizations design of non fragile robust controllers design of low complexity digital controllers analysis of quantization effects in fuzzy controllers

Structure and Synthesis of PID Controllers Aniruddha Datta,Ming-Tzu Ho,Shankar P. Bhattacharyya,2013-03-14 In many industrial applications the existing constraints mandate the use of controllers of low and fixed order while typically modern methods of optimal control produce high order controllers The authors seek to start to bridge the resultant gap and present a novel methodology for the design of low order controllers such as those of the P PI and PID types Written in a self contained and tutorial fashion this book first develops a fundamental result generalizing a classical stability theorem the Hermite Biehler Theorem and then applies it to designing controllers that are widely used in industry It contains material on current techniques for PID controller design stabilization of linear time invariant plants using PID controllers optimal design with PID controllers robust and non fragile PID controller design stabilization of first order systems with time delay constant gain stabilization with desired damping constant gain stabilization of discrete time plants *Data-driven Methods for Fault Detection and Diagnosis in Chemical Processes* Evan L. Russell,Leo H. Chiang,Richard D. Braatz,2012-12-06 Early and accurate fault detection and diagnosis for modern chemical plants can minimise downtime increase the safety of plant operations and reduce manufacturing costs The process monitoring techniques that have been most effective in practice are based on models constructed almost entirely from process data The goal of the book is to present the theoretical background and practical techniques for data driven process monitoring Process monitoring techniques presented include Principal component analysis Fisher discriminant analysis Partial least squares Canonical variate analysis The text demonstrates the application of all of the data driven process monitoring techniques to the Tennessee Eastman plant simulator demonstrating the strengths and weaknesses of each approach in detail This aids the reader in selecting the right method for his process application Plant simulator and homework problems in which students apply the process monitoring techniques to a nontrivial simulated process and can compare their performance with that obtained in the case studies in the text are included A number of additional homework problems encourage the reader to implement and obtain a deeper understanding of the techniques The reader will obtain a background in data driven techniques for fault detection and diagnosis including the ability to implement the techniques and to know how to select the right technique for a particular application

Nonlinear Model-based Process Control Rashid M. Ansari,Moses O. Tade,2012-12-06 The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering The rapid development of control technology has an impact on all areas of the control discipline New theory new controllers actuators sensors new industrial processes computer methods new applications new philosophies new challenges Much of this development work resides in

industrial reports feasibility study papers and the reports of advanced collaborative projects The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination The last decade has seen considerable interest in reviving the fortunes of non linear control In contrast to the approaches of the 60S 70S and 80S a very pragmatic agenda for non linear control is being pursued using the model based predictive control paradigm This text by R Ansari and M Tade gives an excellent synthesis of this new direction Two strengths emphasized by the text are i four applications found in refinery processes are used to give the text a firm practical continuity ii a non linear model based control architecture is used to give the method a coherent theoretical framework

Nonlinear Identification and Control G.P. Liu, 2012-12-06 The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering The rapid development of control technology has an impact on all areas of the control discipline New theory new controllers actuators sensors new industrial processes computer methods new applications new philosophies new challenges Much of this development work resides in industrial reports feasibility study papers and the reports of advanced collaborative projects The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination The time for nonlinear control to enter routine application seems to be approaching Nonlinear control has had a long gestation period but much of the past has been concerned with methods that involve formal nonlinear functional model representations It seems more likely that the breakthrough will come through the use of other more flexible and amenable nonlinear system modelling tools This Advances in Industrial Control monograph by Guoping Liu gives an excellent introduction to the type of new nonlinear system modelling methods currently being developed and used Neural networks appear prominent in these new modelling directions The monograph presents a systematic development of this exciting subject It opens with a useful tutorial introductory chapter on the various tools to be used In subsequent chapters Doctor Liu leads the reader through identification and then onto nonlinear control using nonlinear system neural network representations

Identification and Control of Sheet and Film Processes Andrew P. Featherstone, Jeremy G. VanAntwerp, Richard D. Braatz, 2012-12-06 Sheet and film processes include coating papermaking metal rolling and polymer film extrusion Products produced by these processes include paper bumper stickers plastic bags windshield safety glass and sheet metal The total capitalization of industries that rely on these processes is well over 500 billion worldwide These processes are notorious for being difficult to control The goal of this book is to present the theoretical background and practical techniques for the identification and control of sheet and film processes It is explained why many existing industrial control systems perform poorly for sheet and film processes Identification and control algorithms are described and illustrated which provide consistent and reliable product quality These algorithms include an experimental design technique that ensures that informative data are collected during input output experimentation model identification techniques that produce a process model and an estimate of its

accuracy and control techniques that take into account actuator constraints as well as robustness to model uncertainties The algorithms covered in this book are truly the state of the art Variations on some of the algorithms have been implemented on industrial sheet and film processes Other algorithms are in various stages of implementation All of the algorithms have been applied to realistic simulation models constructed from industrial plant data many of these studies are included in this book

MICAI 2002: Advances in Artificial Intelligence Carlos Coello Coello,Alvaro de Albornoz,Luis E. Sucar,Osvaldo C.

Battistutti,2002-03-27 This book constitutes the refereed proceedings of the Second Mexican International Conference on Artificial Intelligence MICAI 2002 held in Merida Yucatán Mexico in April 2002 The 56 revised full papers presented were carefully reviewed and selected from more than 85 submissions from 17 countries The papers are organized in topical sections on robotics and computer vision heuristic search and optimization speech recognition and natural language processing logic neural networks machine learning multi agent systems uncertainty management and AI tools and applications

Adaptive Control with Recurrent High-order Neural Networks George A. Rovithakis,Manolis A.

Christodoulou,2012-12-06 The series Advances in Industrial Control aims to report and encourage technology transfer in control engineering The rapid development of control technology has an impact on all areas of the control discipline New theory new controllers actuators sensors new industrial processes computer methods new applications new philosophies new challenges Much of this development work resides in industrial reports feasibility study papers and the reports of advanced collaborative projects The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination Neural networks is one of those areas where an initial burst of enthusiasm and optimism leads to an explosion of papers in the journals and many presentations at conferences but it is only in the last decade that significant theoretical work on stability convergence and robustness for the use of neural networks in control systems has been tackled George Rovithakis and Manolis Christodoulou have been interested in these theoretical problems and in the practical aspects of neural network applications to industrial problems This very welcome addition to the Advances in Industrial Control series provides a succinct report of their research The neural network model at the core of their work is the Recurrent High Order Neural Network RHONN and a complete theoretical and simulation development is presented Different readers will find different aspects of the development of interest The last chapter of the monograph discusses the problem of manufacturing or production process scheduling

Aerodynamik axialer

Turbokompressoren Franz Joos,2020-06-29 Dieses Fachbuch gibt einen fundierten Einblick in die mehrdimensionale Aerodynamik von Turbokompressoren anhand aktueller Designmerkmale sowie deren physikalischer Grundlagen Zur Effizienzsteigerung von Gasturbinen und Industriekompressoren werden die Beschäufelungen mehrdimensional ausgelegt

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Table of Contents Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control

1. Understanding the eBook Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - The Rise of Digital Reading Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Advantages of eBooks Over Traditional Books
2. Identifying Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - User-Friendly Interface
4. Exploring eBook Recommendations from Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Personalized Recommendations
 - Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control User Reviews and Ratings

- Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control and Bestseller Lists
- 5. Accessing Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control Free and Paid eBooks
 - Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control Public Domain eBooks
 - Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control eBook Subscription Services
 - Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control Budget-Friendly Options
- 6. Navigating Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control eBook Formats
 - ePub, PDF, MOBI, and More
 - Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control Compatibility with Devices
 - Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Highlighting and Note-Taking Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Interactive Elements Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
- 8. Staying Engaged with Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
- 9. Balancing eBooks and Physical Books Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Compressor Surge And Rotating Stall Modeling And Control Advances In

Industrial Control

10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Setting Reading Goals Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Fact-Checking eBook Content of Compressor Surge And Rotating Stall Modeling And Control Advances In Industrial Control
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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