

•ADVANCES IN INDUSTRIAL CONTROL•

Nikolaos Xiros

# Robust Control of Diesel Ship Propulsion

Xiros



Robust Control of Diesel Ship Propulsion



Springer

# Robust Control Of Diesel Ship Propulsion

**John C. Eidson**



## **Robust Control Of Diesel Ship Propulsion:**

*Robust Control of Diesel Ship Propulsion* Nikolaos Xiros, 2002-08-05 Based on the author's research and practical projects he presents a broad view of the needs and problems of the shipping industry in this area. The book covers several models and control types developing an integrated nonlinear state space model of the marine propulsion system. **Robust Control of Diesel Ship Propulsion** Nikolaos Xiros, 2012-12-06 This book covers a number of models and control types. An integrated nonlinear state space model of the marine propulsion system is developed. This is based upon physical principles that incorporate uncertainties arising from engine thermodynamics and disturbances arising from propeller hydrodynamics. The model employs artificial neural networks to depict the nonlinearities of the thermochemical processes of engine power torque generation and the engine turbocharger dynamical interaction. Neural nets combine the required mathematical flexibility and formalism with numerical training and calibration options using either thermodynamic engine models or measured data series. The neural state space model is decomposed appropriately to provide a linearised perturbation model suitable for controller synthesis. The proportional integral derivative control law is examined under the perspective of shaft speed regulation for enhanced disturbance rejection of the propeller load. The typical marine shafting system dynamics and configuration allow for a smart implementation of the D term on shaft torque feedback. Full state feedback control is examined for increased robustness of the compensated plant against parametric uncertainty and neglected dynamics. The H requirements on the closed loop transfer matrix are appropriately decomposed to similar ones on scalar transfer functions which give specifications that are easier to manipulate. In effect the methods are comparatively assessed and suggestions and practical applications are given. This synthetic approach to propulsion plant control and operational problems should prove useful for both theoreticians and practitioners and can be easily adopted for the control of other processes or systems outside the marine field as well. **Fault Detection and Fault-Tolerant Control Using Sliding Modes** Halim Alwi, Christopher Edwards, Chee Pin Tan, 2011-06-07 Fault Detection and Fault tolerant Control Using Sliding Modes is the first text dedicated to showing the latest developments in the use of sliding mode concepts for fault detection and isolation. FDI and fault tolerant control in dynamical engineering systems. It begins with an introduction to the basic concepts of sliding modes to provide a background to the field. This is followed by chapters that describe the use and design of sliding mode observers for FDI using robust fault reconstruction. The development of a class of sliding mode observers is described from first principles through to the latest schemes that circumvent minimum phase and relative degree conditions. Recent developments have shown that the field of fault tolerant control is a natural application of the well known robustness properties of sliding mode control. A family of sliding mode control designs incorporating control allocation which can deal with actuator failures directly by exploiting redundancy is presented. Various realistic case studies specifically highlighting aircraft systems and including results from the implementation of these designs on a motion flight simulator are described. A reference and guide for researchers in fault

detection and fault tolerant control this book will also be of interest to graduate students working with nonlinear systems and with sliding modes in particular 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

Control of Traffic Systems in Buildings Sandor A. Markon,Hajime Kita,Hiroshi Kise,Thomas Bartz-Beielstein,2006-11-22

Transportation systems in buildings are part of everyday life whether ferrying people twenty storeys up to the office or moving luggage at the airport 21st century society relies on them This book presents the latest in analysis and control of transportation systems in buildings focusing primarily on elevator groups The theory and design of passenger and cargo transport systems are covered with operational examples and topics of special interest

**Model Predictive Control System Design and Implementation Using MATLAB®** Liuping Wang,2009-02-14 Model Predictive Control System Design and Implementation Using MATLAB proposes methods for design and implementation of MPC systems using basis functions that confer the following advantages continuous and discrete time MPC problems solved in similar design frameworks a parsimonious parametric representation of the control trajectory gives rise to computationally efficient algorithms and better on line performance and a more general discrete time representation of MPC design that becomes identical to the traditional approach for an appropriate choice of parameters After the theoretical presentation coverage is given to three industrial applications The subject of quadratic programming often associated with the core optimization algorithms of MPC is also introduced and explained The technical contents of this book is mainly based on advances in MPC using state space models and basis functions This volume includes numerous analytical examples and problems and MATLAB programs and exercises

Optimal Real-time Control of Sewer Networks Magdalene Marinaki,Markos

Papageorgiou,2005-01-07 A sine qua non of control system development for modern sewer networks is the preservation of the water system around a network s outflow s Several approaches have been proposed for the optimisation of sewage control and Optimal Real time Control of Sewer Networks provides a comparative synthesis of a central sewer network flow control based on two of these nonlinear optimal and multivariable feedback control Testing and comparison of these protocols are made on the basis of their control results for the large scale sewer network located around the river Obere Iller in Bavaria The control strategies implemented within this network are based on this study From the selection of possible methods of control and moving to the implementation of those methods in a real sewer system this monograph will be invaluable to control and civil engineers working in sewage flow and wastewater treatment and of interest to academics wishing to see how their ideas on optimal control work out when practically applied

**Process Modelling for Control**

Benoît Codrons,2005-08-30 Many process control books focus on control design techniques taking the construction of a process model for granted Process Modelling for Control concentrates on the modelling steps underlying a successful design

answering questions like How should I carry out the identification of my process in order to obtain a good model How can I assess the quality of a model with a view to using it in control design How can I ensure that a controller will stabilise a real process and achieve a pre specified level of performance before implementation What is the most efficient method of order reduction to facilitate the implementation of high order controllers Different tools namely system identification model controller validation and order reduction are studied in a framework with a common basis closed loop identification with a controller that is close to optimal will deliver models with bias and variance errors ideally tuned for control design As a result rules are derived applying to all the methods that provide the practitioner with a clear way forward despite the apparently unconnected nature of the modelling tools Detailed worked examples representative of various industrial applications are given control of a mechanically flexible structure a chemical process and a nuclear power plant Process Modelling for Control uses mathematics of an intermediate level convenient to researchers with an interest in real applications and to practising control engineers interested in control theory It will enable working control engineers to improve their methods and will provide academics and graduate students with an all round view of recent results in modelling for control 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

**Piezoelectric Transducers for Vibration Control and Damping** S.O. Reza Moheimani, Andrew J. Fleming, 2006-06-29 Flexible mechanical systems experience undesirable vibration in response to environmental and operational forces Vibrations can limit the accuracy of sensitive instruments or cause significant errors in applications where high precision positioning is essential so their control is often a necessity Piezoelectric transducers have been used in countless applications as sensors and actuators When traditional passive vibration control techniques won't do piezoelectric transducers in conjunction with feedback controllers can suppress vibrations effectively This monograph presents recent developments in vibration control systems that employ embedded piezoelectric sensors and actuators It covers various ways in which active vibration control systems can be designed for piezoelectric laminated structures high lighting real time implementation The text contains numerous examples and experimental results obtained from laboratory scale apparatus with details of how similar setups can be built

**Measurement, Control, and Communication Using IEEE 1588** John C. Eidson, 2006-05-01 A common sense of time among the elements of a distributed measurement and control system allows the use of new techniques in solving problems with complex synchronization requirements or arising from the interaction of many sensors and actuators Such a common sense of time may be accomplished using the standard IEEE 1588 2002 to synchronize real time clocks integral to each component of the system IEEE 1588 expands the performance capabilities of Ethernet networks so that they become relevant for measurement and control this monograph embodies the first unified treatment of the associated technology standards

and applications Readers will gain understanding of the technological context of IEEE 1588 and its role in a variety of application settings To engineers this monograph provides detailed discussion of the complex features of the standard Together with the essential material on best practice and implementation issues these provide invaluable assistance in the design of new applications

**Control of Ships and Underwater Vehicles** Khac Duc Do,Jie Pan,2009-08-09 Most ocean vessels are underactuated but control of their motion in the real ocean environment is essential Starting with a review of the background on ocean vessel dynamics and nonlinear control theory the authors systematic approach is based on various nontrivial coordinate transformations coupled with advanced nonlinear control design methods This strategy is then used for the development and analysis of a number of ocean vessel control systems with the aim of achieving advanced motion control tasks including stabilization trajectory tracking path tracking and path following Control of Ships and Underwater Vehicles offers the reader new results in the nonlinear control of underactuated ocean vessels efficient designs for the implementation of controllers on underactuated ocean vessels numerical simulations and real time implementations of the control systems designed on a scale model ship for each controller developed to illustrate their effectiveness and afford practical guidance

Modelling and Control of Mini-Flying Machines Pedro Castillo Garcia,Rogelio Lozano,Alejandro Enrique Dzul,2005-12-08 Modelling and Control of Mini Flying Machines is an exposition of models developed to assist in the motion control of various types of mini aircraft Planar Vertical Take off and Landing aircraft helicopters quadrotor mini rotorcraft other fixed wing aircraft blimps For each of these it propounds detailed models derived from Euler Lagrange methods appropriate nonlinear control strategies and convergence properties real time experimental comparisons of the performance of control algorithms review of the principal sensors on board electronics real time architecture and communications systems for mini flying machine control including discussion of their performance detailed explanation of the use of the Kalman filter to flying machine localization To researchers and students in nonlinear control and its applications Modelling and Control of Mini Flying Machines provides valuable insights to the application of real time nonlinear techniques in an always challenging area

*Optimal Trajectory Planning and Train Scheduling for Urban Rail Transit Systems* Yihui Wang,Bin Ning,Ton van den Boom,Bart De Schutter,2016-04-21 This book contributes to making urban rail transport fast punctual and energy efficient significant factors in the importance of public transportation systems to economic environmental and social requirements at both municipal and national levels It proposes new methods for shortening passenger travel times and for reducing energy consumption addressing two major topics 1 train trajectory planning the authors derive a nonlinear model for the operation of trains and present several approaches for calculating optimal and energy efficient trajectories within a given schedule and 2 train scheduling the authors develop a train scheduling model for urban rail systems and optimization approaches with which to balance total passenger travel time with energy efficiency and other costs to the operator Mixed integer linear programming and pseudospectral methods are among the new methods proposed for single and multi train systems for the

solution of the nonlinear trajectory planning problem which involves constraints such as varying speed restrictions and maximum traction braking force Signaling systems and their effects are also accounted for in the trajectory planning model Origin destination passenger demand is included in the model formulation for train scheduling Iterative convex programming and efficient bi level approaches are utilized in the solution of the train scheduling problem In addition the splitting rates and route choices of passengers are also optimized from the system point of view The problems and solutions described in Optimal Trajectory Planning and Train Scheduling for Urban Rail Transit Systems will interest researchers studying public transport systems and logistics whether from an academic or practitioner background as well as providing a real application for anybody studying optimization theory and predictive control

Practical Grey-box Process Identification Torsten P. Bohlin, 2006-09-07 This book reviews the theoretical fundamentals of grey box identification and puts the spotlight on MoCaVa a MATLAB compatible software tool for facilitating the procedure of effective grey box identification It demonstrates the application of MoCaVa using two case studies drawn from the paper and steel industries In addition the book answers common questions which will help in building accurate models for systems with unknown inputs

Advanced Fuzzy Logic Technologies in Industrial Applications Ying Bai, Hanqi Zhuang, Dali Wang, 2007-01-17 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 In the mid 1960s and contemporary with Kalman's pioneering papers on state space models and optimal control L A Zadeh began publishing papers on fuzzy sets It took another decade before the fuzzy logic controller due to Mamdani and Assilion was reported in the literature ca 1974 and now the fuzzy logic control paradigm is entering its fifth decade of development and application Thus this new Advances in Industrial Control monograph edited by Ying Bai Hanqi Zhuang and Dali Wang on fuzzy logic control and its practical application comes as a timely reminder of the wide range of problems that can be solved by this continually evolving methodology

*Practical PID Control* Antonio Visioli, 2006-11-03 This book focuses on those functionalities that can provide significant improvements in Proportional integral derivative PID performance in combination with parameter tuning In particular the choice of filter to make the controller proper the use of a feedforward action and the selection of an anti windup strategy are addressed The book gives the reader new methods for improving the performance of the most widely applied form of control in industry

*Modelling and Analysis of Hybrid Supervisory Systems* Emilia Villani, Paulo Eigi Miyagi, Robert Valette, 2007-05-18 This book introduces a formalism for modeling complex and large scale systems that merges Petri nets differential equation systems and object oriented methods

It describes a method that starts from the requirements of a supervisory system and results in a proposal for such a system. The book also presents a validation procedure that allows verification of the formal properties of the hybrid model. *Fuzzy Logic, Identification and Predictive Control* Jairo Jose Espinosa Oviedo, Joos P.L. Vandewalle, Vincent Wertz, 2007-01-04

Modern industrial processes and systems require adaptable advanced control protocols able to deal with circumstances demanding judgement rather than simple yes no on off responses. Circumstances where a linguistic description is often more relevant than a cut and dried numerical one. The ability of fuzzy systems to handle numeric and linguistic information within a single framework renders them efficacious for this purpose. *Fuzzy Logic Identification and Predictive Control* first shows you how to construct static and dynamic fuzzy models using the numerical data from a variety of real industrial systems and simulations. The second part exploits such models to design control systems employing techniques like data mining. This monograph presents a combination of fuzzy control theory and industrial serviceability that will make a telling contribution to your research whether in the academic or industrial sphere and also serves as a fine roundup of the fuzzy control area for the graduate student.

*Diagnosis of Process Nonlinearities and Valve Stiction* Ali Ahammad Shoukat Choudhury, Sirish L. Shah, Nina F. Thornhill, 2008-08-20 were published in the series as the contributed volume *Process Control Performance Assessment From Theory to Implementation* with Andrzej Ordys, Damian Udzielny and Michael Johnson as Editors. ISBN 978 1 84628 623 0 2007. Along with this good progress in process controller assessment methods, researchers have also been investigating techniques to diagnose what is causing the process or control loop degradation. This requires the use of on line data to identify faults via new diagnostic indicators of typical process problems. A significant focus of some of this research has been the issue of valve problems, a research direction that has been motivated by some industrial statistics that show up to 40% of control loops having performance degradation attributable to valve problems. Shoukat Choudhury, Sirish Shah and Nina Thornhill have been very active in this research field for a number of years and have written a coherent and consistent presentation of their many research results as this monograph *Diagnosis of Process Nonlinearities and Valve Stiction*. The *Advances in Industrial Control* series is pleased to welcome this new and substantial contribution to the process diagnostic literature. The reader will find the exploitation of the extensive process data archives created by today's process computer systems one theme in the monograph. From another viewpoint, the use of higher order statistics could be considered to provide a continuing link to the earlier methods of the statistical process control paradigm.

*Unmanned Rotorcraft Systems* Guowei Cai, Ben M. Chen, Tong Heng Lee, 2011-06-01. *Unmanned Rotorcraft Systems* explores the research and development of fully functional miniature UAV, unmanned aerial vehicle, rotorcraft and provides a complete treatment of the design of autonomous miniature rotorcraft UAVs. The unmanned system is an integration of advanced technologies developed in communications, computing and control areas and is an excellent testing ground for trialing and implementing modern control techniques. Included are detailed expositions of systematic hardware construction, software systems integration.



aerodynamic modeling and automatic flight control system design Emphasis is placed on the cooperative control and flight formation of multiple UAVs vision based ground target tracking and landing on moving platforms Other issues such as the development of GPS less indoor micro aerial vehicles and vision based navigation are also discussed in depth utilizing the vision based system for accomplishing ground target tracking attacking and landing cooperative control and flight formation of multiple unmanned rotorcraft and future research directions on the related areas

*Deadlock Resolution in Automated Manufacturing Systems* ZhiWu Li,MengChu Zhou,2009-02-12 Deadlock problems in flexible manufacturing systems FMS have received more and more attention in the last two decades Petri nets are one of the more promising mathematical tools for tackling deadlocks in various resource allocation systems In a system modeled with Petri nets siphons are tied to the occurrence of deadlock states as a structural object The book systematically introduces the novel theory of siphons traps and elementary siphons of Petri nets as well as the deadlock control strategies for FMS developed from it Deadlock prevention methods are examined comparatively The many FMS examples presented to demonstrate the concepts and results of this book range from the simple to the complex Importantly to inspire and motive the reader s interest in further research a number of interesting and open problems in this area are proposed at the end of each chapter

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