Turbocharging The Internal Combustion Engine

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TY BRADLEY

Artificial Intelligence and Data Driven Optimization of Internal Combustion Engines Nova Science Publishers
An advanced level introductory book covering fundamental aspects, design and dynamics of electric and hybrid electric vehicles There is significant demand for an understanding of the fundamentals, technologies, and design of electric and hybrid electric vehicles and their components from researchers, engineers, and graduate students. Although there is a good body of work in the literature, there is still a great need for electric and hybrid vehicle teaching materials. Electric and Hybrid Vehicles: Technologies, Modeling and Control – A Mechatronic Approach is based on the authors' current research in vehicle systems and will include chapters on vehicle propulsion systems, the fundamentals of vehicle dynamics, EV and HEV technologies, chassis systems, steering control systems, and state, parameter and force estimations. The book is highly illustrated, and examples will be given throughout the book based on real applications and challenges in the automotive industry. Designed to help a new generation of engineers needing to master the principles of and further advances in hybrid vehicle technology Includes examples of real applications and challenges in the automotive industry with problems and solutions Takes a mechatronics approach to the study of electric and hybrid electric vehicles, appealing to mechanical and electrical engineering interests Responds to the increase in demand of universities offering courses in newer electric vehicle technologies
10th International Conference on Turbochargers and Turbocharging Elsevier
Internal combustion engines still have a potential for substantial improvements, particularly with regard to fuel efficiency and environmental compatibility. These goals can be achieved with help of control systems. Modeling and Control of Internal Combustion Engines (ICE) addresses these issues by offering an introduction to cost-effective model-based control system design for ICE. The primary emphasis is put on the ICE and its auxiliary devices. Mathematical models for these processes are developed in the text and selected feedforward and feedback control problems are discussed. The appendix contains a summary of the most important controller analysis and design methods, and a case study that analyzes a simplified idle-speed control problem. The book is written for students interested in the design of classical and novel ICE control systems.
Internal Combustion Engines Robert Bentley, Incorporated
Improvements to a small diesel engine turbocharger were made based on data gathered during a previous Army contract. The improved turbocharger was fabricated and tested on a small, four cylinder, 239 CID diesel engine. Engine dynamometer test data revealed a 2 to 9 percent reduction in fuel consumption at all points over the operating envelope. A turbocharger was operated for 1011 hours at speeds between 70000 and 78000 rpm without incident. The ball bearings were in excellent condition at the end of the test. A math model of the engine and turbocharger was generated. The model was used to estimate 13 Mode Federal Diesel Emissions Cycle, the LA4 driving cycle and the application of the variable area turbine nozzle (VATN) turbocharger to a diesel engine driven generator set. A recommendation was made to build a gen set demo unit. A fuel savings of 8 to 10 percent was estimated for a 30KW DED generator set. (Author).
Internal Combustion Engines Pearson Higher Ed
The increasing demands for internal combustion engines with regard to fuel consumption, emissions and driveability lead to more actuators, sensors and complex control functions. A systematic implementation of the electronic control systems requires mathematical models from basic design through simulation to calibration. The book treats physically-based as well as models based experimentally on test benches for gasoline (spark ignition) and diesel (compression ignition) engines and uses them for the design of the different control functions. The main topics are: - Development steps for engine control - Stationary and dynamic experimental modeling - Physical models of intake, combustion, mechanical system, turbocharger, exhaust, cooling, lubrication, drive train - Engine control structures, hardware, software, actuators, sensors, fuel supply, injection system, camshaft - Engine control methods, static and dynamic feedforward and feedback control, calibration and optimization, HiL, RCP, control software development - Control of gasoline engines, control of air/fuel, ignition, knock, idle, coolant, adaptive control functions - Control of diesel engines, combustion models, air flow and exhaust recirculation control, combustion-pressure-based control (HCCI), optimization of feedforward and feedback control, smoke limitation and emission control This book is an introduction to electronic engine management with many practical examples, measurements and research results. It is aimed at advanced students of electrical, mechanical, mechatronic and control engineering and at practicing engineers in the field of combustion engine and automotive engineering.
14th International Conference on Turbochargers and Turbocharging Elsevier
Turbocharging the Internal Combustion EngineJohn Wiley & Sons IncorporatedTurbocharging : The internal combustion engineSupercharging of Internal Combustion EnginesSpringer Science & Business MediaTurbocharging the Internal Combustion

EngineTurbocharging the Internal Combustion EngineFundamentals of TurbochargingSociety of Automotive Engineers

Fundamentals of Turbocharging Springer Science & Business Media

Now in its fourth edition, this textbook remains the indispensable text to guide readers through automotive or mechanical engineering, both at university and beyond. Thoroughly updated, clear, comprehensive and well-illustrated, with a wealth of worked examples and problems, its combination of theory and applied practice aids in the understanding of internal combustion engines, from thermodynamics and combustion to fluid mechanics and materials science. This textbook is aimed at third year undergraduate or postgraduate students on mechanical or automotive engineering degrees. New to this Edition: - Fully updated for changes in technology in this fast-moving area - New material on direct injection spark engines, supercharging and renewable fuels - Solutions manual online for lecturers

Turbocharging of Small Internal Combustion Engine as a Means of Improving Engine/Application System Fuel Economy-Further Turbocharger Improvements John Wiley & Sons Incorporated

Since the publication of the Second Edition in 2001, there have been considerable advances and developments in the field of internal combustion engines. These include the increased importance of biofuels, new internal combustion processes, more stringent emissions requirements and characterization, and more detailed engine performance modeling, instrumentation, and control. There have also been changes in the instructional methodologies used in the applied thermal sciences that require inclusion in a new edition. These methodologies suggest that an increased focus on applications, examples, problem-based learning, and computation will have a positive effect on learning of the material, both at the novice student, and practicing engineer level. This Third Edition mirrors its predecessor with additional tables, illustrations, photographs, examples, and problems/solutions. All of the software is ‘open source’, so that readers can see how the computations are performed. In addition to additional java applets, there is companion Matlab code, which has become a default computational tool in most mechanical engineering programs.

Charging the Internal Combustion Engine Turbocharging the Internal Combustion Engine

This thesis presents a method for turbocharging single cylinder four stroke internal combustion engines, a model used to evaluate it, an experimental setup used to test it, and the findings of this experiment. A turbocharged engine has better fuel economy, cost efficiency, and power density than an equivalently sized, naturally aspirated engine. Most multi-cylinder diesel engines are turbocharged for this reason. However, due to the timing mismatch between the exhaust stroke, when the turbocharger is powered, and the intake stroke, when the engine intakes air, turbocharging is not used in commercial single cylinder engines. Single cylinder engines are ubiquitous in developing world off grid power applications such as tractors, generators, and water pumps due to their low cost. Turbocharging these engines could give users a lower cost and more fuel efficient engine. The proposed solution is to add an air capacitor, in the form of a large volume intake manifold, in between the turbocharger compressor and the engine intake to smooth out the flow.

11th International Conference on Turbochargers and Turbocharging Springer Science & Business Media

Turbocharging can provide a cost-effective means for increasing the power output and fuel economy of an internal combustion engine. It is commonly used on multi-cylinder engines, but not on commercial single-cylinder engines due to the phase mismatch between the exhaust stroke (when the turbocharger is powered) and the intake stroke (when the engine requires the compressed air). This work explores overcoming the phase mismatch problem by adding an air capacitor: a volume added in series with the intake manifold between the turbocharger compressor and the engine intake. The function of the air capacitor is to buffer the output from the turbocharger compressor and deliver pressurized air during the intake stroke. This research focuses on demonstrating the feasibility of using an air capacitor to enable turbocharging single cylinder internal combustion engines. An analytical model of the system was created from first principles, which showed that the air capacitor turbocharging method could increase power output by up to 40% without heat transfer and up to 70% with heat transfer elements included in the intake manifold (such as an intercooler). An initial, proof-of-concept experiment was created using a generator as a dynamometer. With an air capacitor volume seven times the engine capacity, this setup was able to produce 29% more power compared to the same engine naturally aspirated. A numerical model was developed in Ricardo Wave to predict the performance of turbocharged single cylinder engines with air capacitors under different conditions. An experimental engine with accompanying dynamometer was constructed to demonstrate the effects of manifold sizing on engine performance and to experimentally validate the model. The experiment showed that the model was able to predict power output with an accuracy of 8% of peak power, fuel consumption within 7% error, air mass flow rates with 10% error, and manifold pressures within 7% error. The model was then combined with a simulated annealing optimization scheme in Matlab in order to conceptualize designs for the geometry and timings of single-cylinder turbocharged engines intended for different commercial applications. The optimization showed that adding an air capacitor and turbocharger to a 0.44L engine, with slight modifications to the valve and injector timings, could increase power by 88% compared to natural aspiration. By also modifying the bore and stroke, the turbocharged engine with an air capacitor could reduce fuel consumption by 8% compared to a naturally aspirated engine with equivalent peak power output.

Internal Combustion Engine Downsizing by Inproving on Reovery Waste Energy Using Turbocharger Bloomsbury Publishing

This book covers all aspects of supercharging internal combustion engines. It details charging systems and components, the theoretical basic relations between engines and charging systems, as well as layout and evaluation criteria for best interaction. Coverage also describes recent experiences in design and development of supercharging systems, improved graphical presentations, and most advanced calculation and simulation tools.

Turbocharger Integration into Multidimensional Engine Simulations to Enable Transient Load Cases Amer Society of Mechanical

Direct injection enables precise control of the fuel/air mixture so that engines can be tuned for improved power and fuel economy, but ongoing research challenges remain in improving the technology for commercial applications. As fuel prices escalate DI

engines are expected to gain in popularity for automotive applications. This important book, in two volumes, reviews the science and technology of different types of DI combustion engines and their fuels. Volume 1 deals with direct injection gasoline and CNG engines, including history and essential principles, approaches to improved fuel economy, design, optimisation, optical techniques and their applications. Reviews key technologies for enhancing direct injection (DI) gasoline engines Examines approaches to improved fuel economy and lower emissions Discusses DI compressed natural gas (CNG) engines and biofuels

Turbocharging the Internal Combustion Engine Elsevier

Turbocharging is used more widely than ever in internal combustion engines. Most diesel engines are increasingly so. Turbocharger technology and often commercial turbocharger components are being applied in many other fields including fuel cells, miniature gas turbine engines, and air cycle refrigerators. This book is the first comprehensive treatment of turbochargers and turbocharging to be made widely available in the last twenty years. It is intended to serve as both an introduction to the turbocharger itself, and to the problems of matching a turbocharger with an internal combustion engine. The turbocharger is a highly sophisticated device, which has been described as aerospace gas turbine engineering allied to mass production techniques. Undoubtedly the key to commercial success lies in achieving the correct compromise between performance, life, cost, and this runs as a continuous thread the book. The operation of turbomachines is fundamentally different from that of reciprocating machines, so that the turbocharged engine has many complex characteristics, not all of them desirable. The means by which the advantageous characteristics are exploited to the full, and the technology required to overcome disadvantageous, are fully explained. [Source : d'après la 4e de couverture].

Internal Combustion Engines Springer Science & Business Media

Artificial Intelligence and Data Driven Optimization of Internal Combustion Engines summarizes recent developments in Artificial Intelligence (AI)/Machine Learning (ML) and data driven optimization and calibration techniques for internal combustion engines. The book covers AI/ML and data driven methods to optimize fuel formulations and engine combustion systems, predict cycle to cycle variations, and optimize after-treatment systems and experimental engine calibration. It contains all the details of the latest optimization techniques along with their application to ICE, making it ideal for automotive engineers, mechanical engineers, OEMs and R&D centers involved in engine design. Provides AI/ML and data driven optimization techniques in combination with Computational Fluid Dynamics (CFD) to optimize engine combustion systems Features a comprehensive overview of how AI/ML techniques are used in conjunction with simulations and experiments Discusses data driven optimization techniques for fuel formulations and vehicle control calibration

Turbocharging the Internal Combustion Engine Springer

This study analyzes the feasibility of using hydrogen as fuel in an internal combustion engine (ICE), and explores methods of increasing engine power. The current state of the hydrogen industry is discussed, including the merits and detriments of hydrogen use in internal combustion engines with respect to gasoline ICEs and hydrogen fuel cells. The properties of hydrogen and how they present unique advantages and disadvantages to the operation of ICEs is addressed. The purpose and theory of pressure boosting is discussed, and calculations are conducted regarding the performance of a chosen turbocharger and intercooler system, incorporating respective efficiencies, pressure losses and performance gains at chosen engine operating parameters. Finally, the performance gained by the designed pressure boosting system is analytically determined, and the results are compared to the naturally aspirated (unboosted) hydrogen engine and a gasoline engine. The effectiveness of pressure boosting as a means of making hydrogen a more viable ICE fuel is discussed in the context of the results.

Turbocharging of Small Internal Combustion Engines as a Means of Improving Engine/Application System Fuel Economy CRC Press

Traditionally, the study of internal combustion engines operation has focused on the steady-state performance. However, the daily driving schedule of automotive and truck engines is inherently related to unsteady conditions. In fact, only a very small portion of a vehicle’s operating pattern is true steady-state, e. g. , when cruising on a motorway. Moreover, the most critical conditions encountered by industrial or marine engines are met during transients too. Unfortunately, the transient operation of turbocharged diesel engines has been associated with slow acceleration rate, hence poor driveability, and overshoot in particulate, gaseous and noise emissions. Despite the relatively large number of published papers, this very important subject has been treated in the past scarcely and only segmentally as regards reference books. Merely two chapters, one in the book Turbocharging the Internal Combustion Engine by N. Watson and M. S. Janota (McMillan Press, 1982) and another one written by D. E. Winterbone in the book The Thermodynamics and Gas Dynamics of Internal Combustion Engines, Vol. II edited by J. H. Horlock and D. E. Winterbone (Clarendon Press, 1986) are dedicated to transient operation. Both books, now out of print, were published a long time ago. Then, it seems reasonable to try to expand on these pioneering works, taking into account the recent technological advances and particularly the global concern about environmental pollution, which has intensified the research on transient (diesel) engine operation, typically through the Transient Cycles certification of new vehicles.

19. Internationales Stuttgarter Symposium Elsevier

This text, by a leading authority in the field, presents a fundamental and factual development of the science and engineering underlying the design of combustion engines and turbines. An extensive illustration program supports the concepts and theories discussed.

Supercharging the Reciprocating Internal Combustion Engine Penguin

The future market forces and environmental considerations in the passenger car and commercial vehicle sector mean more stringent engine downsizing is far more prevalent. Therefore, novel systems are required to provide boosting solutions including hybrid, electric-motor and exhaust waste energy recovery systems for high efficiency, response, reliability, durability and compactness. The current emission legislations and environmental trends for reducing CO2 and fuel consumption are the major market forces in the land and marine transport industries. The internal combustion engine is the key product and downsizing, efficiency and economy are the driving forces for development for both spark ignition (SI) and compression ignition (CI) engines in both markets. Future market forces and environmental considerations for transportation, specifically in the passenger car, commercial vehicle and the marine sectors mean more stringent engine downsizing. This international

conference is the latest in the highly successful and prestigious series held regularly since 1978. These proceedings from the InstitutionOCOs highly successful and prestigious series address current and novel aspects of turbocharging systems design, boosting solutions for engine downsizing and improvements in efficiency, and present the latest research and development in this growing and innovative area. Focuses on boosting solutions including hybrid, electric-motor and exhaust waste energy recovery systemsExplores the current need for high efficiency, reliability, durability and compactness in recovery systemsExamines what new systems developments are underway"

Turbochargers and Turbocharging Springer-Verlag

For a one-semester, undergraduate-level course in Internal Combustion Engines. This applied thermoscience text explores the basic principles and applications of various types of internal combustion engines, with a major emphasis on reciprocating engines. It covers both spark ignition and compression ignition engines—as well as those operating on four-stroke cycles and on two stroke cycles—ranging in size from small model airplane engines to the larger stationary engines. The full text downloaded to your computer With eBooks you can: search for key concepts, words and phrases make highlights and notes as you study share your notes with friends eBooks are downloaded to your computer and accessible either offline through the Bookshelf (available as a free download), available online and also via the iPad and Android apps. Upon purchase, you'll gain instant access to this eBook. Time limit The eBooks products do not have an expiry date. You will continue to access your digital ebook products whilst you have your Bookshelf installed.

Springer

Whether youre interested in better performance on the road or extra horsepower to be a winner on the track, this book gives you the knowledge you need to get the most out of your engine and its turbocharger system. Find out what works and what doesnt, which turbo is right for your needs, and what type of set-up will give you that extra boost. Bell shows you how to select and install the right turbo, how to prep your engine, test the systems, and integrate a turbo with EFI or carbureted engine.

Maximum Boost John Wiley & Sons

This report presents the results of prototype manufacturing, rig testing, application, and engine testing of a small advanced technology turbocharger. The turbocharger features variable turbine nozzles, ball bearings supported rotor system, self contained lube system and a broad operating range compressor. The purpose of the work was to show the potential benefits of the subject turbocharger in enhancing specific fuel consumption, emissions, and transient response of a diesel engine. The work was accomplished through laboratory testing of hardware and subsequent mathematical duty cycle simulation using the acquired data. The proposed turbocharger was manufactured and successfully run on a turbocharger test rig. Compressor maps were generated for several compressor trims with vaned and vaneless diffusers. A turbocharger was successfully run for 53 hours on a John Deere, 239 cubic inch, four cylinder, diesel engine. Fuel consumption and emissions data were obtained for this engine as well as the 'as received' turbocharged engine and the engine with no turbocharger.