



- L.P. water
- H.P. water
- Cooling water
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Water Injection Gasoline Engine

Michael Günther, Marc Sens



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Potential of Water Injection for Gasoline Engines by Means of a 3D-CFD Virtual Test Bench Antonino Vacca,2021 Water injection is one of the most promising technologies to improve the engine combustion efficiency by mitigating knock occurrences and controlling exhaust gas temperature before turbine As result the engine can operate at stoichiometric conditions over the whole engine map even during the more power demanding RDE cycles Antonino Vacca presents a methodology to study and optimize the effect of water injection for gasoline engines by investigating different engine layouts and injection strategies through the set up of a 3D CFD virtual test bench He investigates indirect and direct water injection strategies to increase the engine knock limit and to reduce exhaust gas temperature for several operating points Contents Influence of Water Vapour on Flame Speed and Auto Ignition Optimization of the Water Injector Targeting Mixture Formation Induced by Water Injection Water Injection in Combination with Miller Cycle Target Groups Researchers and students in the field of automotive engineering Automotive engineers About the Author Antonino Vacca obtained a PhD at the research Institute of Automotive Engineering IFS University of Stuttgart and he is currently project leader at FKFS Stuttgart Germany responsible for the development of innovative combustion concepts for gasoline and gas engines **Knocking in Gasoline Engines** Michael Günther,Marc Sens,2017-11-21 The book includes the papers presented at the conference discussing approaches to prevent or reliably control knocking and other irregular combustion events The majority of today s highly efficient gasoline engines utilize downsizing High mean pressures produce increased knocking which frequently results in a reduction in the compression ratio at high specific powers Beyond this the phenomenon of pre ignition has been linked to the rise in specific power in gasoline engines for many years Charge diluted concepts with high compression cause extreme knocking potentially leading to catastrophic failure The introduction of RDE legislation this year will further grow the requirements for combustion process development as residual gas scavenging and enrichment to improve the knock limit will be legally restricted despite no relaxation of the need to reach the main center of heat release as early as possible New solutions in thermodynamics and control engineering are urgently needed to further increase the efficiency of gasoline engines Reciprocating Engine Combustion Diagnostics Rakesh Kumar Maurya,2019-03-19 This book deals with in cylinder pressure measurement and its post processing for combustion quality analysis of conventional and advanced reciprocating engines It offers insight into knocking and combustion stability analysis techniques and algorithms in SI CI and LTC engines and places special emphasis on the digital signal processing of in cylinder pressure signal for online and offline applications The text gives a detailed description on sensors for combustion measurement data acquisition and methods for estimation of performance and combustion parameters The information provided in this book enhances readers basic knowledge of engine combustion diagnostics and serves as a comprehensive ready reference for a broad audience including

graduate students course instructors researchers and practicing engineers in the automotive oil and other industries concerned with internal combustion engines

[Investigation of Innovative Water Injection Strategies for Gasoline Engines by Means of a 3D-CFD Virtual Engine Test Bench](#) Edoardo Rossi,2024 This book focuses on the investigation of innovative engine technologies that can improve the efficiency of internal combustion engines and reduce their environmental impact In particular water injection is examined as a means of improving engine behavior The possible combination of water injection with renewable fuels is also a topic of the book The results of this experimental and numerical research show positive results that can be used for further research and development of engines Content 3D CFD Simulation Environment the Virtual Engine Test Bench Experimental Spray Analysis and 3D CFD Injection Model Calibration Applicability of Water Injection in Combination with an eFuel Water in Fuel Emulsions at the Virtual Engine Test Bench Target Groups Students and researchers in the field of automotive engineering esp engine technology Engineers in the automotive industry About the Author Edoardo Rossi is a project manager in the virtual engine development department at the FKFS where he did his PhD He works on innovative solutions for future powertrain technologies for motor vehicles

[Combustion Engines Development](#) Günter P. Merker,Christian Schwarz,Rüdiger Teichmann,2011-09-24 Combustion Engines Development nowadays is based on simulation not only of the transient reaction of vehicles or of the complete driveshaft but also of the highly unsteady processes in the carburation process and the combustion chamber of an engine Different physical and chemical approaches are described to show the potentials and limits of the models used for simulation

[HCCI and CAI Engines for the Automotive Industry](#) Hua Zhao,2007-09-10 Homogeneous charge compression ignition HCCI controlled auto ignition CAI has emerged as one of the most promising engine technologies with the potential to combine fuel efficiency and improved emissions performance offering reduced nitrous oxides and particulate matter alongside efficiency comparable with modern diesel engines Despite the considerable advantages its operational range is rather limited and controlling the combustion timing of ignition and rate of energy release is still an area of on going research Commercial applications are however close to reality HCCI a

Potential of Water Injection for Gasoline Engines by Means of a 3D-CFD Virtual Test Bench Antonino Vacca,2020-12-15 Water injection is one of the most promising technologies to improve the engine combustion efficiency by mitigating knock occurrences and controlling exhaust gas temperature before turbine As result the engine can operate at stoichiometric conditions over the whole engine map even during the more power demanding RDE cycles Antonino Vacca presents a methodology to study and optimize the effect of water injection for gasoline engines by investigating different engine layouts and injection strategies through the set up of a 3D CFD virtual test bench He investigates indirect and direct water injection strategies to increase the engine knock limit and to reduce exhaust gas temperature for several operating points

Automotive Spark-Ignited Direct-Injection Gasoline Engines F. Zhao,M.-C. Lai,D.L. Harrington,2000-02-08 The process of fuel injection spray atomization and vaporization charge cooling mixture preparation

and the control of in cylinder air motion are all being actively researched and this work is reviewed in detail and analyzed. The new technologies such as high pressure common rail gasoline injection systems and swirl atomizing gasoline fuel injections are discussed in detail as these technologies along with computer control capabilities have enabled the current new examination of an old objective the direct injection stratified charge DISC gasoline engine. The prior work on DISC engines that is relevant to current GDI engine development is also reviewed and discussed. The fuel economy and emission data for actual engine configurations have been obtained and assembled for all of the available GDI literature and are reviewed and discussed in detail. The types of GDI engines are arranged in four classifications of decreasing complexity and the advantages and disadvantages of each class are noted and explained. Emphasis is placed upon consensus trends and conclusions that are evident when taken as a whole thus the GDI researcher is informed regarding the degree to which engine volumetric efficiency and compression ratio can be increased under optimized conditions and as to the extent to which unburned hydrocarbon UBHC NO_x and particulate emissions can be minimized for specific combustion strategies. The critical area of GDI fuel injector deposits and the associated effect on spray geometry and engine performance degradation are reviewed and important system guidelines for minimizing deposition rates and deposit effects are presented. The capabilities and limitations of emission control techniques and after treatment hardware are reviewed in depth and a compilation and discussion of areas of consensus on attaining European Japanese and North American emission standards presented. All known research prototype and production GDI engines worldwide are reviewed as to performance emissions and fuel economy advantages and for areas requiring further development. The engine schematics control diagrams and specifications are compiled and the emission control strategies are illustrated and discussed. The influence of lean NO_x catalysts on the development of late injection stratified charge GDI engines is reviewed and the relative merits of lean burn homogeneous direct injection engines as an option requiring less control complexity are analyzed.

Assessment of Fuel Economy Technologies for Light-Duty Vehicles National Research Council, Division on Engineering and Physical Sciences, Board on Energy and Environmental Systems, Committee on the Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy, 2011-06-03. Various combinations of commercially available technologies could greatly reduce fuel consumption in passenger cars sport utility vehicles minivans and other light duty vehicles without compromising vehicle performance or safety. Assessment of Technologies for Improving Light Duty Vehicle Fuel Economy estimates the potential fuel savings and costs to consumers of available technology combinations for three types of engines spark ignition gasoline compression ignition diesel and hybrid. According to its estimates adopting the full combination of improved technologies in medium and large cars and pickup trucks with spark ignition engines could reduce fuel consumption by 29 percent at an additional cost of 2 200 to the consumer. Replacing spark ignition engines with diesel engines and components would yield fuel savings of about 37 percent at an added cost of approximately 5 900 per vehicle and replacing spark ignition

engines with hybrid engines and components would reduce fuel consumption by 43 percent at an increase of 6 000 per vehicle The book focuses on fuel consumption the amount of fuel consumed in a given driving distance because energy savings are directly related to the amount of fuel used In contrast fuel economy measures how far a vehicle will travel with a gallon of fuel Because fuel consumption data indicate money saved on fuel purchases and reductions in carbon dioxide emissions the book finds that vehicle stickers should provide consumers with fuel consumption data in addition to fuel economy information

Introduction to Modeling and Control of Internal Combustion Engine Systems Lino

Guzzella, Christopher Onder, 2013-03-14 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

Performance with Economy David Vizard, 1988

Automotive Fuels

Reference Book Paul Richards, 2014-03-05 The first two editions of this title published by SAE International in 1990 and 1995 have been best selling definitive references for those needing technical information about automotive fuels This long awaited new edition has been thoroughly revised and updated yet retains the original fundamental fuels information that readers find so useful This book is written for those with an interest in or a need to understand automotive fuels Because automotive fuels can no longer be developed in isolation from the engines that will convert the fuel into the power necessary to drive our automobiles knowledge of automotive fuels will also be essential to those working with automotive engines Small quantities of fuel additives increasingly play an important role in bridging the gap that often exists between fuel that can easily be produced and fuel that is needed by the ever more sophisticated automotive engine This book pulls together in a single extensively referenced volume the three different but related topics of automotive fuels fuel additives and engines and shows how all three areas work together It includes a brief history of automotive fuels development followed by chapters on automotive fuels manufacture from crude oil and other fossil sources One chapter is dedicated to the manufacture of automotive fuels and fuel blending components from renewable sources The safe handling transport and storage of fuels from all sources are covered New combustion systems to achieve reduced emissions and increased efficiency are discussed and the way in which the fuels physical and chemical characteristics affect these combustion processes and the emissions produced are included There is also discussion on engine fuel system development and how these different systems affect the corresponding fuel requirements Because the book is for a global market fuel system technologies that only exist in the

legacy fleet in some markets are included The way in which fuel requirements are developed and specified is discussed This covers test methods from simple laboratory bench tests through engine testing and long term test procedures

Designing and Tuning High-Performance Fuel Injection Systems Greg Banish,2009 Greg Banish takes his best selling title Engine Management Advanced Tuning one step further as he goes in depth on the combustion basics of fuel injection as well as benefits and limitations of standalone Learn useful formulas VE equation and airflow estimation and more Also covered are setups and calibration creating VE tables creating timing maps auxiliary output controls start to finish calibration examples with screen shots to document the process Useful appendixes include glossary and a special resources guide with standalone manufacturers and test equipment manufacturers

Internal Combustion Engine Fundamentals John B. Heywood,1988 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

Handbook of Atomization and Sprays Nasser Ashgriz,2011-02-18 Atomization and sprays are used in a wide range of industries mechanical chemical aerospace and civil engineering material science and metallurgy food pharmaceutical forestry environmental protection medicine agriculture meteorology and others Some specific applications are spray combustion in furnaces gas turbines and rockets spray drying and cooling air conditioning powdered metallurgy spray painting and coating inhalation therapy and many others The Handbook of Atomization and Sprays will bring together the fundamental and applied material from all fields into one comprehensive source Subject areas included in the reference are droplets theoretical models and numerical simulations phase Doppler particle analysis applications devices and more

Fundamentals of Fuel Injection and Emission in Two-Stroke Engines Wadysaw Mitianiec,2018 The main goal of the book is the presentation of the last theoretical and experimental works concerning fuel injection systems mainly in small power two stroke engines as well as in marine engines This book includes thirteen chapters devoted to the processes of fuel injection and the combustion that takes place in a stratified charge within the cylinders of two stroke engines In the first two chapters the division into different injection systems in two stroke engines and each injection system is briefly described Various theoretical and practical solutions of fueling system designs are described In Chapter Three mathematical models the spatial movement of gas in the cylinder and the combustion chamber are introduced taking into account the turbulence of the charge Chapter Four relates to the behavior of fuel injected into the gaseous medium including evaporation processes disintegration and processes occurring while the fuel drops connect with the wall The next section describes the zero dimensional model of fuel injection in two stroke engines along with examples of numerical calculations The sixth chapter is devoted to CFD multi dimensional models of movement and evaporation of the fuel in a closed gaseous medium occurring also in other engine types Chapter Seven describes a two zone model of the combustion process and the effect of the geometry of the combustion chamber on the flame propagation with a simplified verification model of combustion Chapter

Eight compares the propagation phase of gas and liquid fuels concerning direct fuel injection as well as the direct fuel injection from the cylinder head and the thermodynamic parameters of the charge The formation of the components during the combustion process in the direct fuel injection two stroke engine was obtained by numerical calculations and results are discussed in Chapter Nine Chapter Ten describes the parameters of the two stroke engine with a direct fuel injection carried out at the Cracow University of Technology Additionally the chapter presents CFD simulations of fuel propagation and combustion processes taking into account the formation of toxic components and exhaust gas emission The processes of two direct rich mixture injection systems FAST and RMIS developed in CUT are presented in Chapter Eleven Miscellaneous problems of direct fuel injection such as characteristics of fuel injectors problems of direct gaseous fuel injection and the application of fuelling systems in outboard engines and snowmobile vehicles are presented in Chapter Twelve A comparison of working parameters in two and four stroke engines is also mapped out The last chapters contain the final conclusions and remarks concerning fuel injection and emission of exhaust gases in small two stroke engines This book is a comprehensive monograph on fuel injection The author presents a series of theoretical and design information from his own experience and on the basis of the works of other authors The main text intends to direct fuel injection with respect to gas motion in the combustion chamber and influence the injection parameters for exhaust emission The book presents its own theoretical work and experimental tests concerning a two stroke gasoline engine with electrically controlled direct fuel injection The book describes the processes of a general nature also occurring in other types of engines and presents a comparison of different injection systems on working parameters and gas emission The book contains 294 images 290 equations and 16 tables obtained from the CFD simulation and experimental works

Reduced Emissions and Fuel Consumption in Automobile Engines Fred Schäfer, Richard van Basshuysen, 2013-03-09 Over the last several years there has been much discussion on the interrelation of CO₂ emissions with the global warming phenomenon This in turn has increased pressure to develop and produce more fuel efficient engines and vehicles This is the central topic of this book It covers the underlying processes which cause pollutant emissions and the possibilities of reducing them as well as the fuel consumption of gasoline and diesel engines including direct injection diesel engines As well as the engine related causes of pollution which is found in the raw exhaust there is also a description of systems and methods for exhaust post treatment The significant influence of fuels and lubricants both conventional and alternative fuels on emission behavior is also covered In addition to the conventional gasoline and diesel engines lean burn and direct injection gasoline engines and two stroke gasoline and diesel engines are included The potential for reducing fuel consumption and pollution is described as well as the related reduction of CO₂ emissions Finally a detailed summary of the most important laws and regulations pertaining to pollutant emissions and consumption limits is presented This book is intended for practising engineers involved in research and applied sciences as well as for interested engineering students

Vehicle and Automotive Engineering 3 Károly Jármai, Katalin

Voith,2020-10-20 This book presents the proceedings of the third Vehicle and Automotive Engineering conference reflecting the outcomes of theoretical and practical studies and outlining future development trends in a broad field of automotive research The conference s main themes included design manufacturing economic and educational topics **Engine Combustion Instrumentation and Diagnostics** Hua Zhao,Nicos Ladommatos,2001-01-30 This book provides a complete description of instrumentation and in cylinder measurement techniques for internal combustion engines Written primarily for researchers and engineers involved in advanced research and development of internal combustion engines the book provides an introduction to the instrumentation and experimental techniques with particular emphasis on diagnostic techniques for in cylinder measurements **Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles** National Research Council,Division on Engineering and Physical Sciences,Board on Energy and Environmental Systems,Committee on the Assessment of Technologies for Improving Fuel Economy of Light-Duty Vehicles, Phase 2,2015-09-28 The light duty vehicle fleet is expected to undergo substantial technological changes over the next several decades New powertrain designs alternative fuels advanced materials and significant changes to the vehicle body are being driven by increasingly stringent fuel economy and greenhouse gas emission standards By the end of the next decade cars and light duty trucks will be more fuel efficient weigh less emit less air pollutants have more safety features and will be more expensive to purchase relative to current vehicles Though the gasoline powered spark ignition engine will continue to be the dominant powertrain configuration even through 2030 such vehicles will be equipped with advanced technologies materials electronics and controls and aerodynamics And by 2030 the deployment of alternative methods to propel and fuel vehicles and alternative modes of transportation including autonomous vehicles will be well underway What are these new technologies how will they work and will some technologies be more effective than others Written to inform The United States Department of Transportation s National Highway Traffic Safety Administration NHTSA and Environmental Protection Agency EPA Corporate Average Fuel Economy CAFE and greenhouse gas GHG emission standards this new report from the National Research Council is a technical evaluation of costs benefits and implementation issues of fuel reduction technologies for next generation light duty vehicles Cost Effectiveness and Deployment of Fuel Economy Technologies for Light Duty Vehicles estimates the cost potential efficiency improvements and barriers to commercial deployment of technologies that might be employed from 2020 to 2030 This report describes these promising technologies and makes recommendations for their inclusion on the list of technologies applicable for the 2017 2025 CAFE standards

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