

Fluent Engine Combustion Injection

The main objective of this computational study is to investigate the optimum injection and spark parameters for the direct injection spark ignition (DISI) Wankel rotary engine using diesel fuel. Currently only port fuel injected gasoline rotary engines are available in the automotive industry. Compared to reciprocating type engines rotary engine is mechanically simple, less vibrate, have higher power to weight ratio and achieve better performance at high rpm. Due to the inherent low fuel efficiency of rotary engine and increasing gas prices, application of the rotary engine in conventional automobiles is decreasing. This project seeks to introduce DISI technology to the rotary engine thus increase the fuel efficiency allowing it to be another efficient power source option for aero and automotive applications. DISI technology is the latest trend in the automobile manufacturing. This technology helped to combine benefits of both compression ignition (CI) and spark ignition (SI) engines into a single efficient internal combustion process. Multi-fuel capabilities, reduced operating pressures, and reduced compression ratios make this technology applicable for rotary engines. In this study diesel fuel, as opposed to gasoline, is introduced into the rotary engine using DISI technology. Due to high technological advancements used in DISI engines, it is expensive to experimentally incorporate this technology to a new engine. Accurately designed computational analyses can reduce both time and cost by cutting extra experimental test trials. For this computational fluid dynamics (CFD) study ANSYS FLUENT commercial software was used to integrate the DISI technology into a rotary engine model which was designed in Solidworks and meshed in GAMBIT. When creating the engine model, many parameters have to be

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considered. Engine geometry, injectors, and spark plugs were identified as the most important components needed to be investigated when integrating DISI technology into the rotary engine. By using a readily available rotary engine, direct injector, and spark plug, the number of parameters for the optimization process were reduced. The most important parameters were picked to evaluate the optimum single injection and spark locations. Full factorial experimental design was used to estimate the sensitivity of different combinations of parameters. This was followed by a statistical sensitivity study using JMP 800 commercial software to determine the most and least sensitive parameters to analyze for the optimum setup of single injection rotary engine combustion. Contour plots of fuel consumption, CO₂ generated, equivalence ratio, average temperatures, and pressures were used to support the results. The feasibility of multiple injections was also studied by means of their power outputs and fuel efficiencies. Optimum locations, amounts of fuel, number of orifices and orientations of orifices were included when evaluating optimum lead (second) injector. Similar studies were carried out to check the applicability of a third injector. From the results it can be observed that a dual injection setup provided optimum performance from the DISI rotary engine.

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.

Lean Combustion: Technology and Control, Second Edition outlines and explains the latest advances in lean combustion technology and systems. Combustion under sufficiently fuel-

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lean conditions can have the desirable attributes of high efficiency and low emissions. The book offers readers both the fundamentals and latest developments in how lean burn (broadly defined) can increase fuel economy and decrease emissions, while still achieving desired power output and performance. This volume brings together research and design of lean combustion systems across the technology spectrum in order to explore the state-of-the-art in lean combustion. Readers will learn about advances in the understanding of ultra-lean fuel mixtures and how new types of burners and approaches to managing heat flow can reduce problems often found with lean combustion (such as slow, difficult ignition and frequent flame extinction). This book offers abundant references and examples of real-world applications. New to this edition are significantly revised chapters on IC engines and stability/oscillations, and new case studies and examples. Written by a team of experts, this contributed reference book aims to teach its reader to maximize efficiency and minimize both economic and environmental costs. Presents a comprehensive collection of lean burn technology across potential applications, allowing readers to compare and contrast similarities and differences Provides an extensive update on IC engines including compression ignition (diesel), spark ignition, and homogeneous charge compression ignition (HCCI) Includes an extensive revision to the Stability/Oscillations chapter Includes use of alternative fuels such as biogas and hydrogen for relevant technologies Covers new developments in lean combustion using high levels of pre-heat and heat recirculating burners, as well as the active control of lean combustion instabilities

This book comprises select peer-reviewed proceedings of the 26th National Conference on IC Engines and Combustion (NCICEC) 2019 which was organised by the Department of

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Mechanical Engineering, National Institute of Technology Kurukshetra under the aegis of The Combustion Institute-Indian Section (CIIS). The book covers latest research and developments in the areas of combustion and propulsion, exhaust emissions, gas turbines, hybrid vehicles, IC engines, and alternative fuels. The contents include theoretical and numerical tools applied to a wide range of combustion problems, and also discusses their applications. This book can be a good reference for engineers, educators and researchers working in the area of IC engines and combustion.

A Gasoline Direct Injection (GDI) engine enables an increased fuel efficiency and higher power output than a conventional Port Fuel Injection (PFI) system. By injecting pressurized fuel straight into each cylinder of an internal-combustion engine, the degree of fuel atomization is increased, as well as the fuel vaporization rate. In order to further harness the effects of direct injection, ethanol is implemented as a fuel. The cooling effect of ethanol fuel droplets changing to vapor inside the combustion chamber facilitates a higher compression ratio, thus increasing engine power and efficiency. Three dimensional computational simulation is used to investigate the feasibility of ethanol and gasoline-ethanol mixtures as a fuel over varying compression ratios in a GDI engine. ANSYS Workbench is used to build a dynamic mesh of the varying compression ratio models, in conjunction with SolidWorks modeling software. To simulate flow physics, fuel injection, and combustion in the engine, ANSYS Fluent is employed. A parametric study of the effect of spark timing and compression ratio under ethanol operation at cruise RPM is performed. Additionally, a dual-injector gasoline-ethanol setup is implemented for the GDI engine and the effects of injection timing and mixture fraction of fuel is analyzed. Both ethanol and bi-fuel operation settings

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are found to provide significantly higher horsepower than the stock GDI engine. The dual-injector, bi-fuel operation is found to provide a specific fuel consumption comparable to the stock engine while providing substantially higher output. The results yield a promising fuel delivery strategy which can be appealing to many direct injection engine applications.

This book comprises research studies of novel work on combustion for sustainable energy development. It offers an insight into a few viable novel technologies for improved, efficient and sustainable utilization of combustion-based energy production using both fossil and bio fuels. Special emphasis is placed on micro-scale combustion systems that offer new challenges and opportunities. The book is divided into five sections, with chapters from 3-4 leading experts forming the core of each section. The book should prove useful to a variety of readers, including students, researchers, and professionals.

The matters discussed and presented in the chapters of this book cover a wide spectrum of topics and research methods commonly used in the field of engine combustion technology and vehicle functional systems. This book contains the results of both computational analyses and experimental studies on jet and reciprocating combustion engines as well heavy-duty onroad vehicles. Special attention is devoted to research and measures toward preventing the emission of harmful exhaust components, reducing fuel consumption or using unconventional methods of engine fueling or using renewable and alternative fuels in different applications. Some technical improvements in design and control of vehicle systems are also presented.

This volume includes versions of papers selected from those presented at the THIESEL 2000 Conference on Thermofluidynamic Processes in Diesel Engines, held at the Universidad Politecnica de Valencia, during the period of

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September 13 to 15, 2000. The papers are grouped into seven thematic areas: State of the Art and Prospective, Fuels for Diesel Engines, Injection System and Spray Formation, Combustion and Pollutant Formation, Modelling, Experimental Techniques, and Air Management. These areas cover most of the technologies and research strategies that may allow Light Duty and Heavy Duty Diesel engines to comply with current and forthcoming emission standards, while maintaining or improving fuel consumption. The main objectives of the conference were to bring together ideas and experience from Industry and Universities to facilitate interchange of information and to promote discussion of future research and development needs. The technical papers emphasised the use of diagnostic and simulation techniques and their relationship to engineering practice and the advancement of the Diesel engine. We hope that this approach, which proved to be successful at the Conference, is reflected in this volume. We thank all those who contributed to the success of the Conference, and particularly the members of the Advisory Committee who assessed abstracts and chaired many of the technical sessions. We are also grateful to participants who presented their work or contributed to the many discussions. Finally, the Conference benefitted from financial support from the organisations listed below and we are glad to have this opportunity to record our gratitude.

This book focuses on the two-phase flow problems relevant in the automotive and power generation sectors. It includes fundamental studies on liquid-gas two-phase interactions, nucleate and film boiling, condensation, cavitation, suspension flows as well as the latest developments in the field of two-phase problems pertaining to power generation systems. It also discusses the latest analytical, numerical and experimental techniques for investigating the role of two-

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phase flows in performance analysis of devices like combustion engines, gas turbines, nuclear reactors and fuel cells. The wide scope of applications of this topic makes this book of interest to researchers and professionals alike. The project is to study the spray breakup and mixture in Gasoline Direct Injection (GDI) The spray breakup and fuel air mixture in the injector system really important to improve the fuel efficiency of Gasoline Direct Injection (GDI) Engine. Engine by using simulation. By using the ANSYS Design Modeler, the design of the injector with different inlet size and combustion chamber has been done. Then, by using Computational Fluid Dynamic (CFD), ANSYS Fluent the flow simulation has been run. The results extracted from the simulation are spray cone angle and penetration length. The simulation is done based on different size of nozzle which are 0.2, 0.3, 0.4 and 0.5 mm. While for another variable is injection pressure which are 3, 6, 10, 15 and 20 Mpa. From the result, the spray cone angle is decreasing as the pressure increase which means the spray cone angle is inversely proportional to the injection pressure. While for another results, the penetration length is directly proportional to the injection pressure. The penetration length is increase as the injection pressure is increase. But, as the nozzle diameter increase with the same pressure, the penetration length is decreases.

This machine is destined to completely revolutionize cylinder diesel engine up through large low speed t- engine engineering and replace everything that exists. stroke diesel engines. An appendix lists the most (From Rudolf Diesel's letter of October 2, 1892 to the important standards and regulations for diesel engines. publisher Julius Springer.) Further development of diesel engines as economiz- Although Diesel's stated goal has never been fully ing, clean, powerful and convenient drives for road and achievable of

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course, the diesel engine indeed revolutionized nonroad use has proceeded quite dynamically in the diesel drive systems. This handbook documents the last twenty years in particular. In light of limited oil current state of diesel engine engineering and technology reserves and the discussion of predicted climate change. The impetus to publish a Handbook of Diesel engine development work continues to concentrate on reducing fuel consumption and utilizing alternative transformation of his idea for a rational heat engine fuels while keeping exhaust as clean as possible as well into reality more than 100 years ago. Once the patent as further increasing diesel engine power density and was filed in 1892 and work on his engine commenced enhancing operating performance.

This research monograph presents both fundamental science and applied innovations on several key and emerging technologies involving fossil and alternate fuel utilization in power and transport sectors from renowned experts in the field. Some of the topics covered include: autoignition in laminar and turbulent nonpremixed flames; Langevin simulation of turbulent combustion; lean blowout (LBO) prediction through symbolic time series analysis; lasers and optical diagnostics for next generation IC engine development; exergy destruction study on small DI diesel engine; and gasoline direct injection. The book includes a chapter on carbon sequestration and optimization of enhanced oil and gas recovery. The contents of this book will be useful to researchers and professionals working on all aspects on combustion.

This book focuses on combustion simulations and optical diagnostics techniques, which are currently used in internal combustion engines. The book covers a variety of simulation techniques, including in-cylinder

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combustion, numerical investigations of fuel spray, and effects of different fuels and engine technologies. The book includes chapters focused on alternative fuels such as DEE, biomass, alcohols, etc. It provides valuable information about alternative fuel utilization in IC engines. Use of combustion simulations and optical techniques in advanced techniques such as microwave-assisted plasma ignition, laser ignition, etc. are few other important aspects of this book. The book will serve as a valuable resource for academic researchers and professional automotive engineers alike.

Volume 2 of the two-volume set *Advanced direct injection combustion engine technologies and development* investigates diesel DI combustion engines, which despite their commercial success are facing ever more stringent emission legislation worldwide. Direct injection diesel engines are generally more efficient and cleaner than indirect injection engines and as fuel prices continue to rise DI engines are expected to gain in popularity for automotive applications. Two exclusive sections examine light-duty and heavy-duty diesel engines. Fuel injection systems and after treatment systems for DI diesel engines are discussed. The final section addresses exhaust emission control strategies, including combustion diagnostics and modelling, drawing on reputable diesel combustion system research and development. Investigates how HSDI and DI engines can meet ever more stringent emission legislation Examines technologies for both light-duty and heavy-duty diesel engines Discusses exhaust emission control strategies, combustion diagnostics and modelling

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This volume contains a selection of papers presented at the 13th International Conference on Marina Navigation and Safety of Sea Transport and is addressed to scientists and professionals in order to share their expert knowledge, experience and research results concerning all aspects of navigation, safety of navigation and sea transportation. The Thirteenth Edition of the most innovative World conference on maritime transport research is designed to find solutions to challenges in waterborne transport, navigation and shipping, mobility of people and goods with respect to energy, infrastructure, environment, safety and security as well as to economic issues.

A comprehensive resource covering the foundational thermal-fluid sciences and engineering analysis techniques used to design and develop internal combustion engines Internal Combustion Engines: Applied Thermosciences, Fourth Edition combines foundational thermal-fluid sciences with engineering analysis techniques for modeling and predicting the performance of internal combustion engines. This new 4th edition includes brand new material on: New engine technologies and concepts Effects of engine speed on performance and emissions Fluid mechanics of intake and exhaust flow in engines Turbocharger and supercharger performance analysis Chemical kinetic modeling, reaction mechanisms, and emissions Advanced combustion processes including low temperature combustion Piston, ring and journal bearing friction analysis The 4th Edition expands on the combined analytical and numerical approaches used

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successfully in previous editions. Students and engineers are provided with several new tools for applying the fundamental principles of thermodynamics, fluid mechanics, and heat transfer to internal combustion engines. Each chapter includes MATLAB programs and examples showing how to perform detailed engineering computations. The chapters also have an increased number of homework problems with which the reader can gauge their progress and retention. All the software is 'open source' so that readers can see in detail how computational analysis and the design of engines is performed. A companion website is also provided, offering access to the MATLAB computer programs. 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

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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.

Computational Optimization of Internal Combustion Engines presents the state of the art of computational models and optimization methods for internal combustion engine development using multi-dimensional computational fluid dynamics (CFD) tools and genetic algorithms. Strategies to reduce computational cost and mesh dependency are discussed, as well as regression analysis methods. Several case studies are presented in a section devoted to applications, including assessments of: spark-ignition engines, dual-fuel engines, heavy duty and light duty diesel engines. Through regression analysis, optimization results are used to explain complex interactions between engine design parameters, such as nozzle design, injection timing, swirl, exhaust gas recirculation, bore size, and piston bowl shape. Computational Optimization of Internal Combustion Engines demonstrates that the current multi-dimensional CFD tools are mature enough for practical development of internal combustion engines. It is written for researchers and designers in mechanical engineering and the automotive industry.

This book comprises select proceedings of the International Conference on Future Learning Aspects of Mechanical Engineering (FLAME 2018). The book gives an overview of recent developments in the field of thermal and fluid engineering, and covers theoretical and experimental fluid dynamics, numerical methods in heat

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transfer and fluid mechanics, different modes of heat transfer, multiphase transport and phase change, fluid machinery, turbo machinery, and fluid power. The book is primarily intended for researchers and professionals working in the field of fluid dynamics and thermal engineering.

This book presents selected and peer-reviewed proceedings of the International Conference on Thermofluids (KIIT Thermo 2020). It focuses on the latest studies and findings in the areas of fluid dynamics, heat transfer, thermodynamics, and combustion. Some of the topics covered in the book include electronic cooling, HVAC system analysis, inverse heat transfer, combustion, nano-fluids, multiphase flow, high-speed flow, and shock waves. The book includes both experimental and numerical studies along with a few review chapters from experienced researchers, and is expected to lead to new research in this important area. This book is of interest to students, researchers as well as practitioners working in the areas of fluid dynamics, thermodynamics, and combustion.

The MIT mission - "to bring together Industry and Academia and to nurture the next generation in computational mechanics is of great importance to reach the new level of mathematical modeling and numerical solution and to provide an exciting research environment for the next generation in computational mechanics." Mathematical modeling and numerical solution is today firmly established in science and engineering. Research conducted in almost all branches of scientific investigations and the design of systems in practically all

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disciplines of engineering can not be pursued effectively without, frequently, intensive analysis based on numerical computations. The world we live in has been classified by the human mind, for descriptive and analysis purposes, to consist of fluids and solids, continua and molecules; and the analyses of fluids and solids at the continuum and molecular scales have traditionally been pursued separately. Fundamentally, however, there are only molecules and particles for any material that interact on the microscopic and macroscopic scales. Therefore, to unify the analysis of physical systems and to reach a deeper understanding of the behavior of nature in scientific investigations, and of the behavior of designs in engineering endeavors, a new level of analysis is necessary. This new level of mathematical modeling and numerical solution does not merely involve the analysis of a single medium but must encompass the solution of multi-physics problems involving fluids, solids, and their interactions, involving multi-scale phenomena from the molecular to the macroscopic scales, and must include uncertainties in the given data and the solution results. Nature does not distinguish between fluids and solids and does not ever repeat itself exactly. This new level of analysis must also include, in engineering, the effective optimization of systems, and the modeling and analysis of complete life spans of engineering products, from design to fabrication, to possibly multiple repairs, to end of service. Summary of International Energy Research and Development Activities 1974–1976 is a directory of energy research and development projects conducted in

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various countries such as Canada, Italy, Germany, France, Sweden, and the United Kingdom between 1974 and 1976. A limited number of projects sponsored by international organizations such as the International Atomic Energy Agency are also included. This directory consists of nine chapters and opens with a section on organic sources of energy such as coal, oil and gas, peat, hydrocarbons, and non-fossil organic sources. The next sections focus on thermonuclear energy and plasma physics; fission sources and energy production; geophysical energy sources; conversion technology; and environmental aspects of energy conversion and use. Energy transport, transmission, utilization, and conservation are also covered. The final chapter deals with energy systems and other energy-related research on subjects ranging from car sharing and urban passenger transport to nuclear power plants, energy supply and demand models, and high-power molecular lasers. This monograph will be a valuable resource of information for those involved in energy research and development.

Diesel engines, also known as CI engines, possess a wide field of applications as energy converters because of their higher efficiency. However, diesel engines are a major source of NOX and particulate matter (PM) emissions. Because of its importance, five chapters in this book have been devoted to the formulation and control of these pollutants. The world is currently experiencing an oil crisis. Gaseous fuels like natural gas, pure hydrogen gas, biomass-based and coke-based syngas can be considered as alternative fuels for diesel

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engines. Their combustion and exhaust emissions characteristics are described in this book. Reliable early detection of malfunction and failure of any parts in diesel engines can save the engine from failing completely and save high repair cost. Tools are discussed in this book to detect common failure modes of diesel engine that can detect early signs of failure.

This book highlights the important need for more efficient and environmentally sound combustion technologies that utilise renewable fuels to be continuously developed and adopted. The central theme here is two-fold: internal combustion engines and fuel solutions for combustion systems. Internal combustion engines remain as the main propulsion system used for ground transportation, and the number of successful developments achieved in recent years is as varied as the new design concepts introduced. It is therefore timely that key advances in engine technologies are organised appropriately so that the fundamental processes, applications, insights and identification of future development can be consolidated. In the future and across the developed and emerging markets of the world, the range of fuels used will significantly increase as biofuels, new fossil fuel feedstock and processing methods, as well as variations in fuel standards continue to influence all combustion technologies used now and in coming streams. This presents a challenge requiring better understanding of how the fuel mix influences the combustion processes in various systems. The book allows extremes of the theme to be covered in a simple yet progressive way. Biofuels have recently attracted a lot of attention, mainly as

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alternative fuels for applications in energy generation and transportation. The utilization of biofuels in such controlled combustion processes has the great advantage of not depleting the limited resources of fossil fuels while leading to emissions of greenhouse gases and smoke particles similar to those of fossil fuels. On the other hand, a vast amount of biofuels are subjected to combustion in small-scale processes, such as for heating and cooking in residential dwellings, as well as in agricultural operations, such as crop residue removal and land clearing. In addition, large amounts of biomass are consumed annually during forest and savanna fires in many parts of the world. These types of burning processes are typically uncontrolled and unregulated. Consequently, the emissions from these processes may be larger compared to industrial-type operations. Aside from direct effects on human health, especially due to a sizeable fraction of the smoke emissions remaining inside residential homes, the smoke particles and gases released from uncontrolled biofuel combustion impose significant effects on the regional and global climate. Estimates have shown the majority of carbonaceous airborne particulate matter to be derived from the combustion of biofuels and biomass.

“Production of Biofuels and Numerical Modelling of Chemical Combustion Systems” comprehensively overviews and includes in-depth technical research papers addressing recent progress in biofuel production and combustion processes. To be specific, this book contains sixteen high-quality studies (fifteen research papers and one review paper) addressing techniques and methods for bioenergy and biofuel production as well as challenges in the broad area of process modelling and control in combustion processes.

The main topic of "Fuel injection in automotive engineering" book is fundamental process that determines the development of internal combustion engines and

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performances of automotive vehicles. The book collects original works focused on up-to-date issues relevant to improving injection phenomena per se and injection systems as the engine key components.

Fuel Injection is a key process characterizing the combustion development within Internal Combustion Engines (ICEs) and in many other industrial applications. State of the art in the research and development of modern fuel injection systems are presented in this book. It consists of 12 chapters focused on both numerical and experimental techniques, allowing its proper design and optimization.

Can hydrogen and electricity supply all of the world's energy needs? Handbook of Hydrogen Energy thoroughly explores the notion of a hydrogen economy and addresses this question. The handbook considers hydrogen and electricity as a permanent energy system and provides factual information based on science. The text focuses on a large cross section o

This book presents select proceedings of the International Conference on Future Learning Aspects of Mechanical Engineering (FLAME 2018). The book discusses interdisciplinary areas such as automobile engineering, mechatronics, applied and structural mechanics, bio-mechanics, biomedical instrumentation, ergonomics, biodynamic modeling, nuclear engineering, agriculture engineering, and farm machineries. The contents of the book will benefit both researchers and professionals.

Turbulence is one of the key issues in tackling engineering flow problems. As powerful computers and accurate numerical methods are now available for solving the flow equations, and since engineering applications nearly always involve turbulence effects, the reliability of CFD analysis depends increasingly on the performance of the turbulence models. This series of symposia provides a forum for

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presenting and discussing new developments in the area of turbulence modelling and measurements, with particular emphasis on engineering-related problems. The papers in this set of proceedings were presented at the 5th International Symposium on Engineering Turbulence Modelling and Measurements in September 2002. They look at a variety of areas, including: Turbulence modelling; Direct and large-eddy simulations; Applications of turbulence models; Experimental studies; Transition; Turbulence control; Aerodynamic flow; Aero-acoustics; Turbomachinery flows; Heat transfer; Combustion systems; Two-phase flows. These papers are preceded by a section containing 6 invited papers covering various aspects of turbulence modelling and simulation as well as their practical application, combustion modelling and particle-image velocimetry.

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