Computer Simulation Of Compression Ignition Engine Processes

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Computer Simulation of Turbocharged Spark Ignition Engines
A Computer Simulation of the Turbocharged Turbocompounded Diesel Engine System

JORDYN DAISY

Computer Simulation for a Four-stroke, Direct-injection Diesel Engine Springer Science & Business Media
The numerical simulation of combustion processes in internal combustion engines, including also the formation of pollutants, has become increasingly important in the recent years, and today the simulation of those processes has already become an indispensable tool when - veloping new combustion concepts. While pure thermodynamic models are well-established tools that are in use for the simulation of the transient behavior of complex systems for a long time, the phenomenological models have become more important in the recent years and have also been implemented in these simulation programs. In contrast to this, the thr- dimensional simulation of in-cylinder combustion, i. e. the detailed, integrated and continuous simulation of the process

chain injection, mixture formation, ignition, heat release due to combustion and formation of pollutants, has been significantly improved, but there is still a number of challenging problems to solve, regarding for example the exact description of s- processes like the structure of turbulence during combustion as well as the appropriate choice of the numerical grid. While chapter 2 includes a short introduction of functionality and operating modes of internal combustion engines, the basics of kinetic reactions are presented in chapter 3. In chapter 4 the physical and chemical processes taking place in the combustion chamber are described. Ch- ter 5 is about phenomenological multi-zone models, and in chapter 6 the formation of poll- ants is described.

Combustion Engines Development Universities Press

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.

Computer Simulation of an Low Heat Rejection Direct Injection Diesel Engine Springer Nature

The utilization of mathematical models to numerically describe the performance of internal combustion engines is of great significance in the development of new and improved engines. Today, such simulation models can already be viewed as standard tools, and their importance is likely to increase further as available com puter power is expected to increase and the predictive quality of the models is constantly enhanced. This book describes and discusses the most widely used mathematical models for in-cylinder spray and combustion processes, which are the most important subprocesses affecting engine fuel consumption and pollutant emissions. The relevant thermodynamic, fluid dynamic and chemical principles are summarized, and then the application of these principles to the in-cylinder processes is ex plained. Different modeling approaches for the each subprocesses are compared and discussed with respect to the governing model assumptions and simplifica tions. Conclusions are drawn as to which model approach is appropriate for a specific type of problem in the development process of an engine. Hence, this book may serve both as a graduate level textbook for combustion engineering stu dents and as a reference for professionals employed in the field of combustion en gine modeling. The research necessary for this book was carried out during my employment as a postdoctoral scientist at the Institute of Technical Combustion (ITV) at the Uni versity of Hannover, Germany and at the Engine Research Center (ERC) at the University of Wisconsin-Madison, USA.

Computer Simulation of a Turbocharged Diesel Engine Operating Under Transient Load Conditions Universities Press

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Development of a Real-time Digital Computer Simulation of a Turbocharged Diesel Engine Springer Science & Business Media

This book contains the theory and computer programs for the simulation of spark ignition (SI) engine processes. It starts with the fundamental concepts and goes on to the advanced level and can thus be used by undergraduates, postgraduates and Ph. D.

scholars.

A Computer Simulation of the Turbocharged Turbocompounded Diesel Engine System for Studies of Low Heat Rejection Engine Performance Springer Nature

This book focuses on the simulation and modeling of internal combustion engines. The contents include various aspects of diesel and gasoline engine modeling and simulation such as spray, combustion, ignition, in-cylinder phenomena, emissions, exhaust heat recovery. It also explored engine models and analysis of cylinder bore piston stresses and temperature effects. This book includes recent literature and focuses on current modeling and simulation trends for internal combustion engines. Readers will gain knowledge about engine process simulation and modeling, helpful for the development of efficient and emission-free engines. A few chapters highlight the review of state-of-the-art models for spray, combustion, and emissions, focusing on the theory, models, and their applications from an engine point of view. This volume would be of interest to professionals, post-graduate students involved in alternative fuels, IC engines, engine modeling and simulation, and environmental research.

Diesel engine simulation on a personal computer Springer Science & Business Media

The combination of superior fuel economy and durability has made compression ignition direct injection diesel engines popular worldwide. However, these engines can emit large amounts of ozone-forming pollutants and particulates and so are being subjected to increasingly stringent regulations that require continual improvements in the combustion process. Further, improved engine power density is necessary at high load conditions, before the CIDI engine can be considered a contender in the next generation automotive engine technology. Understanding the physics and chemistry involved in diesel combustion, with its transient effects and the inhomogeneity of spray combustion is quite challenging. Great insight into the physics of the problem can be obtained when an in-cylinder computational analysis is used in conjunction with either an experimental program or through published experimental data. The main area to be investigated to obtain good combustion begins by defining the fuel injection process and the mean diameter of the fuel particle, injection pressure, drag coefficient, rate shaping, etc., correctly. This work presents a methodology to perform the task set out in the previous paragraph and uses experimental data obtained from available literature to construct a numerical model. A modified version of a multidimensional computer code called KIVA3V was used for the computations, with improved sub-models for mean droplet diameter, injection pressure and drop distortion and drag. The results achieved show good agreement with the published experimental data. It has been of special importance to model the spray distribution accurately, as the combustion process and the resulting pollutant emission formation is intimately tied to the in-cylinder fuel distribution. The present scheme has achieved excellent results in these aspects and will make an important contribution to the numerical simulation of the combustion process and pollutant emission formation in compression ignition direct injection engines.

Modeling and Computer Simulation of Internal Combustion Engines Springer Nature

This book focuses on gasoline compression ignition (GCI) which offers the prospect of engines with high efficiency and low exhaust emissions at a lower cost. A GCI engine is a compression ignition (CI) engine which is run on gasoline-like fuels (even on low-octane gasoline), making it significantly easier to control particulates and NOx but with high efficiency. The state of the art development to make GCI combustion feasible on practical vehicles is highlighted, e.g., on overcoming problems on cold start, high-pressure rise rates at high loads, transients, and HC and CO emissions. This book will be a useful guide to those in academia and industry.

Combustion in Homogeneous Charge Compression Ignition Engines Springer Science & Business Media

The direct-injection of natural gas into the compression-ignition engines is attractive, due to its emission advantage and diesel-equivalent efficiency. The computational simulation of this next-generation heavy-duty engine can provide deep insights of the gas injection and ignition characteristics and help understand the emission formation process, and hence, a KIVA-3v based three-dimensional computational model was developed and improved to represent the configuration of a glow plug assisted direct-injection natural gas engine. This thesis presents the important conclusions about the numerical studies of the natural gas ignition and emissions by using this engine computational model. Preliminary simulations revealed that the shield for a glow plug, an ignition assist for natural gas in compression-ignition engines, can highly improve the natural gas ignition stability compared to an unshielded glow plug, and the design of the glow plug shield has great potential for the further improvement of the natural gas ignition. The different shield designs, characterized by the parameters such as shield opening shape, number and distribution, were evaluated by using the improved KIVA model. The simulated results clearly demonstrated the three key functions of a good shield design. A multi-opening shield, consisting of four small openings in a diamond shape, can achieve all three requirements and hence highly reduce the natural gas ignition delay and improve the ignition stability, compared to the original single-opening shield. The proper emission models are critical for the numerical simulations of natural gas engine emissions. For the gaseous species, a kinetic package, CANTERA, is coupled to KIVA CFD code to simulate the formation of important emissions, such as C2H2 and NOx. However, the available detailed mechanisms, such as GRI-3.0, will over-predict the ignition delay at low temperature (

A Study of Computer Simulation in D.I. Diesel Engine Performance and Emission Prediction SAE International

Based on the simulations developed in research groups over the past years, Introduction to Quasi-dimensional Simulation of Spark Ignition Engines provides a compilation of the main ingredients necessary to build up a quasi-dimensional computer simulation scheme. Quasi-dimensional computer simulation of spark ignition engines is a powerful but affordable tool which obtains realistic estimations of a wide variety of variables for a simulated engine keeping insight the basic physical and chemical processes involved in the real evolution of an automotive engine. With low computational costs, it can optimize the design and operation of spark ignition engines as well as it allows to analyze cycle-to-cycle fluctuations. Including details about the structure of a

complete simulation scheme, information about what kind of information can be obtained, and comparisons of the simulation results with experiments, Introduction to Quasi-dimensional Simulation of Spark Ignition Engines offers a thorough guide of this technique. Advanced undergraduates and postgraduates as well as researchers in government and industry in all areas related to applied physics and mechanical and automotive engineering can apply these tools to simulate cyclic variability, potentially leading to new design and control alternatives for lowering emissions and expanding the actual operation limits of spark ignition engines

Computer Simulation Of Compression-Ignition Engine Processes

Simulation and Optimization of Internal Combustion Engines provides the fundamentals and up-to-date progress in multidimensional simulation and optimization of internal combustion engines. While it is impossible to include all the models in a single book, this book intends to introduce the pioneer and/or the often-used models and the physics behind them providing readers with ready-to-use knowledge. Key issues, useful modeling methodology and techniques, as well as instructive results, are discussed through examples. Readers will understand the fundamentals of these examples and be inspired to explore new ideas and means for better solutions in their studies and work. Topics include combustion basis of IC engines, mathematical descriptions of reactive flow with sprays, engine in-cylinder turbulence, fuel sprays, combustions and pollutant emissions, optimization of direct-injection gasoline engines, and optimization of diesel and alternative fuel engines.

A Comprehensive Cycle Analysis And Digital Computer Simulation For Spark-Ignited Engines

This book comprehensively discusses diesel combustion phenomena like ignition delay, fuel-air mixing, rate of heat release, and emissions of smoke, particulate and nitric oxide. It enables quantitative evaluation of these important phenomena and parameters. Most importantly, it attempts to model them with constants that are independent of engine types and hence they could be applied by the engineers and researchers for a general engine. This book emphasizes the importance of the spray at the wall in precisely describing the heat release and emissions for most of the engines on and off-road. It gives models for heat release and emissions. Every model is thoroughly validated by detailed experiments using a broad range of engines. The book describes an elegant quasi-one-dimensional model for heat release in diesel engines with single as well as multiple injections. The book describes how the two aspects, namely, fuel injection rate and the diameter of the combustion bowl in the piston, have enabled meeting advanced emission, noise, and performance standards. The book also discusses the topics of computational fluid dynamics encompassing RANS and LES models of turbulence. Given the contents, this book will be useful for students, researchers and professionals working in the area of vehicle engineering and engine technology. This book will also be a good professional book for practising engineers in the field of combustion engines and automotive engineering.

Combustion Process of Homogeneous Charge Compression Ignition Engine Using Numerical Modeling

This book attempts to provide a simplified framework for the vast

and complex map of technical material that exists on compression-ignition engines, and at the same time include sufficient details to convey the complexity of engine simulation. The emphasis here is on the thermodynamics, combustion physics and chemistry, heat transfer, and friction processes relevant to compression-ignition engines with simplifying assumpations.
Quasi-Dimensional Simulation of Spark Ignition Engines
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