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Fuel Economy of the Gasoline Engine Fuel Economy *Assessment of Fuel Economy Technologies for Light-Duty Vehicles Assessment of Fuel Economy Technologies for Light-Duty Vehicles Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles* Reduced Emissions and Fuel Consumption in Automobile Engines **Reduced Emissions and Fuel Consumption in Automobile Engines** Technological Improvements to Automobile Fuel Consumption **Vehicle Engines** *Numerical On-line Optimisation of Engine Fuel Consumption* **Reduced Emissions and Fuel Consumption in Automobile Engines Fuel Consumption and Consumption Optimization** *75 Ways to Save Gas* Cost, Effectiveness, and Deployment of Fuel Economy Technologies for Light-Duty Vehicles **Recent Kolbenschmidt Work on the Reduction of Passenger Car Engine Fuel Consumption** Potential of Spark Ignition Engine for Increased Fuel Efficiency Reducing Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two **Software Development for Numerical On-line Parallel Optimisation of Engine Fuel Consumption** *A Study of Technological Improvements in Automobile Fuel Consumption: Executive summary* **Engine Design (materials and Fuel Consumption) (1990 - 1995).** A Study of Technological Improvements in Automobile Fuel Consumption A Comparative Study on Influence of EIVC and LIVC on Fuel Economy of A TGDI Engine Part III

Technological Improvements to Automobile Fuel Consumption. Volume I: Executive Summary. Final Report **Influence of Ethanol in Spark Ignition Engine Fuel Consumption** **Evaluation of Techniques for Reducing In-use Automotive Fuel Consumption** Software Developments for Numerical On-line Parallel Optimisation of Engine Fuel Consumption. I. A Survey of the Problem *The Relationship Between Specific Fuel Consumption and Engine Weight for a Series of High-bypass Ratio Engines The Effect of Compression on the Fuel Consumption of a Gasoline Engine* A Study of Technological Improvements in Automobile Fuel Consumption: Appendices. 2 v Effects on Fuel Consumption and Diesel Engine Deposits from Nano-Particle Oil Additive *Fuel Consumption Test of DH-4B with Liberty "12" Engine* **Run-time HEV Engine-generator Power-speed Optimization for Fuel Consumption and Emissions Reduction** A Comparison of Gasoline and Ethanol Fueled Engines in Terms of Total Fossil Fuel Consumption *Minimising Cold Start Fuel Consumption and Emissions from a Gasoline Fuelled Engine Fuel Consumption Corrected for Cooling Drag of an Air-cooled Radial Aircraft Engine at Low Fuel-air Ratios and with Variable Spark Advance* **Smoke and Fuel Consumption Measurements in a Direct Injection Diesel Engine with Variable Swirl** *Preliminary Report on the Influence of Engine Loading on Tractor Field Fuel Consumption by A.N.C. McDonald [and] H.J. Hamblin* Fuel Economy and Emissions of Lean Burn Engines **Automobile Fuel Consumption in Actual Traffic Conditions** Fuel Economy Predictions for Heavy-duty Vehicles and Quasi-dimensional DI Diesel Engine Numerical Modeling

Reliability and power capacity are the only factors in the operation of aircraft engines that are of greater importance than fuel economy. A reduction in engine specific fuel consumption will result in either increased range or increased useful load. If

minimum fuel consumption at any power output is to be achieved, the most favorable conditions of engine operation must be selected. Ethanol fuel is known as Gasohol blend, where there is E5, E85, E100 and etcetera. The figure shows percent of ethanol blend in gasoline. Main function of using gasohol is as alternative fuel. This blend can reduce reliability on gasoline. Using gasohol as fuel will affect engine performance, fuel consumption and emission. Ethanol in gasohol increases the octane number of the fuel, higher octane number fuel allow higher compression ratio in engine. For normal naturally-aspirated engine the common compression ratio is 10:1, but gasohol allow compression ratio up to 15:1. Higher compression ratio leads to better combustion and emissions. Experimentally, gasohol will cause increase in fuel consumptions but reduce in engine power and torque. For this project the engine used is Mitsubishi 4G92, four cylinder, water cooled, four-stroke, and 1.6L. The engine designed virtually in GT-Power software and all engine parameters remain constant. By using GT-Power simulation, brake fuel consumption of naturallyaspirated engine is tested using gasoline and gasohol as fuels. The fuel consumption of the engine was tested different rpm for both gasoline and gasohol. The result of the experiment is important to improve engine fuel consumptions which using gasohol as fuel and give advantages to gasohol engine designer to build reliable engine. 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. 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. 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. This project evaluated the effects of a nano-particle additive when blended with MIL-PRF-46167D OEA-30 Arctic Oil as a baseline fluid. Baseline and additized oil were tested for CAT 1K/1N deposits, in-vehicle and dynamometer fuel economy, and lab tests for physical properties and wear metals. Results from the CAT 1K/1N test showed a positive impact on deposits when using the nano-particle additive. Results for both the in-vehicle and dynamometer fuel consumption testing did not indicate that there was a change in fuel consumption either when using the nano-particle additive, or from carry-over effects after changing back to MIL-PRF-46167D oil. High Temperature Benchtop Corrosion Testing produced results showing an

increase in wear metal concentration, and copper corrosion appearance when utilizing the nano-particle additive. Everyone is looking for ways to save money at the pump, and 75 Ways to Save Gas is an indispensable guide to doing just that. It's chock-full of simple, easy-to-follow tips to help you save fuel-and potentially hundreds, if not thousands, of dollars each year on your gas bill. Here are just Some of the helpful tips inside: Prepare your car before you drive Avoid the extremes of hot and cold Plan your drive Put an end to idling Join a carpool Keep the fuel injectors clean Use the right fuel for your car Lighten up on the brakes Properly inflate the tires Get the junk out of your trunk Book jacket. 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. Medium- and heavy-duty trucks, motor coaches, and transit buses - collectively, "medium- and heavy-duty vehicles", or MHDVs - are used in every sector of the economy. The fuel consumption and greenhouse gas emissions of MHDVs have become a focus of legislative and regulatory action in the past few years. This study is a follow-on to the National Research Council's 2010 report, Technologies and Approaches to Reducing the Fuel Consumption of Medium-and Heavy-Duty Vehicles. That report provided a series of findings and recommendations on the development of regulations for reducing fuel consumption of MHDVs. On September 15, 2011, NHTSA and EPA finalized joint Phase I rules to establish a comprehensive Heavy-Duty National Program to reduce greenhouse gas emissions and fuel consumption for on-road medium- and heavy-duty vehicles. As NHTSA and EPA began working on a second round of standards, the National Academies issued another report, Reducing the Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: First Report, providing recommendations for the Phase II standards. This third and final report focuses on a possible third phase of regulations to be promulgated by these agencies in the next decade. 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. A research team developed the University of Texas Fuel Economy Model to estimate the fuel consumption of both light-duty and heavy-duty vehicles operated on Texas roads. One of the objectives of the model was to be as flexible as possible in order to be capable of simulating a variety of vehicles, payloads, and traffic conditions. For heavy-duty vehicles, there are no prescribed driving cycles, there are no coastdown coefficients available from the EPA, and we relied on experimental brake specific fuel consumption maps for a few heavy-duty diesel engines. Heavy-duty vehicle drive cycles highly depend upon the vehicle load, the grade of the road, the engine size, and the traffic conditions. In order to capture real driving conditions 54 drive cycles with three different Class 8 trucks, three weight configurations, three traffic congestion levels, and two drivers are collected. Drive cycles obtained in this research include road grade and vehicle speed data with time. Due to the lack of data from EPA for calculating the road load force for heavy-duty vehicles, coastdown tests were performed. To generate generic fuel maps for the fuel economy model, a direct injection quasi-dimensional diesel engine model was developed based on in-cylinder images available in the literature. Sandia National Laboratory researchers obtained various images describing diesel spray evolution, spray mixing, premixed combustion, mixing controlled combustion, soot formation, and NOx formation via imaging technologies. Dec combined all of the

available images to develop a conceptual diesel combustion model to describe diesel combustion from the start of injection up to the quasi-steady form of the jet. The end of injection behavior was left undescribed in this conceptual model because no clear image was available due to the chaotic behavior of diesel combustion. A conceptual end-of-injection diesel combustion behavior model was proposed to capture diesel combustion in its life span. A full-cycle quasi-dimensional direct injection diesel engine model was developed that represents the physical models, utilizing the conceptual model developed from imaging experiments and available experiment-based spray models, of the in-cylinder processes. The compression, expansion, and gas exchange stages are modeled via zero-dimensional single zone calculations. A full cycle simulation is necessary in order to capture the initial conditions of the closed section of the cycle and predict the brake specific fuel consumption accurately. The aim of this work, consisting of 9 individual, self-contained booklets, is to describe commercial vehicle technology in a way that is clear, concise and illustrative. Compact and easy to understand, it provides an overview of the technology that goes into modern commercial vehicles. Starting from the customer's fundamental requirements, the characteristics and systems that define the design of the vehicles are presented knowledgeably in a series of articles, each of which can be read and studied on their own. In this volume, Fuel Consumption and Consumption Optimization, the main focus is placed on the factors for optimizing consumption in the conventional vehicle. Fuel consumption can be optimized by four different factors: the technology of the vehicle, the conditions of its operation, the behavior of the driver and the maintenance and upkeep of the vehicle. These aspects are described in a way that is easily understood for training and practical application. As fuel economy and emissions standards become more stringent, Plug-in Hybrid Electric Vehicles (PHEV) using series architectures are being increasingly explored. Due to the decoupling of the Internal

Combustion Engine (ICE) from the road, the primary control challenge in this architecture is the optimization of an ICE control law. A run-time Genset speed controller is presented for use during the charge-sustaining mode in a Series PHEV to find the optimal operating parameters for a conventional diesel engine coupled to an electric generator in terms of minimized fuel consumption and emissions generation. On board vehicle sensors provide real time data to the controller allowing for this method of optimization to be valid regardless of environment or operating conditions. The controller is validated through computer simulations using data from the Embry-Riddle EcoCAR 2 vehicle platform. Compared to the existing static Genset speed controller, the run-time controller resulted in a 40% reduction in fuel consumption and a 45% reduction in NOx production.
Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles evaluates various technologies and methods that could improve the fuel economy of medium- and heavy-duty vehicles, such as tractor-trailers, transit buses, and work trucks. The book also recommends approaches that federal agencies could use to regulate these vehicles' fuel consumption. Currently there are no fuel consumption standards for such vehicles, which account for about 26 percent of the transportation fuel used in the U.S. The miles-per-gallon measure used to regulate the fuel economy of passenger cars. is not appropriate for medium- and heavy-duty vehicles, which are designed above all to carry loads efficiently. Instead, any regulation of medium- and heavy-duty vehicles should use a metric that reflects the efficiency with which a vehicle moves goods or passengers, such as gallons per ton-mile, a unit that reflects the amount of fuel a vehicle would use to carry a ton of goods one mile. This is called load-specific fuel consumption (LSFC). The book estimates the improvements that various technologies could achieve over the next decade in seven vehicle types. For example, using advanced diesel engines in tractor-

trailers could lower their fuel consumption by up to 20 percent by 2020, and improved aerodynamics could yield an 11 percent reduction. Hybrid powertrains could lower the fuel consumption of vehicles that stop frequently, such as garbage trucks and transit buses, by as much 35 percent in the same time frame. 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. Concern about the reduced availability and the increased cost of petroleum fuels prompted great efforts in recent years to reduce the fuel consumption of auto mobiles. The ongoing efforts to reduce fuel consumption have addressed many relevant factors, including increased engine performance, reduced friction, use of lightweight materials, and reduced aerodynamic drag. The results of the investigations assessing the various factors affecting fuel economy have been published in journals, conference proceedings, and in company and government reports. This proliferation of technical information makes it difficult for workers to keep abreast of aU developments. The material presented in this book brings together in a single volume much of the relevant materials, summarizes many of the state-of-the-art theories and data, and provides extensive lists of references. Thus, it is hoped that this book will be a useful reference for specialists and practicing engineers interested in the fuel economy of automobiles. J. C. HILLIARD o. S. SPRINGER vii CONTENTS 1. AUTOMOTIVE FUEL ECONOMY David Cole I. Introduction and Background. . . . . 1 . . . . . n. Fuel Economy Factors . . . . . 9 A. Engine..... 11 B. Drive Train. . . . . 20 . . . . . C. Vehicle Factors. . . . . 22 . . . . . D. Operating Factors. . . . . 28 . . . . . E. Test Cycles . . . . . 32 . . . . . References . . . . . 33 . . . . . 2. FUEL ECONOMY AND EMISSIONS J. T. Kummer I. Introduction ..... . 35 n. Emission Regulations ..... .

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