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R Bogdan



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Particle Filter Retrofit for All Diesel Engines Andreas Mayer, 2008 *Development of an Integrated Diesel Engine, Emissions, and Aftertreatment System Level Model* Stephen B. England, 2006 Electrical Diesel Particulate Filter (DPF) Regeneration, 2013 An exhaust system that processes exhaust generated by an engine includes a diesel particulate filter DPF that is disposed downstream of the engine and that filters particulates from the exhaust An electrical heater is disposed upstream of the DPF and selectively heats the exhaust to initiate combustion of the particulates within the exhaust as it passes therethrough Heat generated by combustion of the particulates induces combustion of particulates within the DPF

Development of an Integrated Diesel Engine, Emissions, and Aftertreatment System Level Model Nawateja Singha, 2008 Influence of Engine Operating Condition and Aftertreatment Component Selection on Diesel Particulate Filter Operation Eric L. Schroeder, 2006 Diesel Particulate Filter (DPF) Regeneration by Electrical Heating of Resistive Coatings, 2008 An exhaust system that processes exhaust generated by an engine includes a diesel particulate filter DPF that is disposed downstream of the engine and that filters particulates from the exhaust An electrical heater is integrally formed in an upstream end of the DPF and selectively heats the exhaust to initiate combustion of the particulates within the exhaust as it passes therethrough Heat generated by combustion of the particulates induces combustion of particulates within the DPF

Diesel Particulate Filter Technology Timothy V Johnson, 2007-03-28 Until recently the complexity of the Diesel Particulate Filter DPF system has hindered its commercial success Stringent regulations of diesel emissions has lead to advancements in this technology therefore mainstreaming the use of DPFs in light and heavy duty diesel filtration applications This book covers the latest and most important research in DPF systems focusing mainly on the advancements of the years 2002 2006 Editor Timothy V Johnson selected the top 29 SAE papers covering the most significant research in this technology

Impact of Particulate Matter Composition on Catalyzed Diesel Particulate Filter Filtration and Regeneration on a Steady State Research Diesel Engine Matthew Bohm, 2005 Electrically Heated DPF Start-up Strategy, 2012 An exhaust system that processes exhaust generated by an engine has a diesel particulate filter DPF that is disposed downstream of the engine and that filters particulates in the exhaust An electrical heater is disposed upstream of the DPF and selectively heats the exhaust to initiate combustion of the particulates Heat generated by combustion of particulates in the heater induces combustion of particulates within the DPF A control module selectively enables current flow to the electrical heater for an initial period of a DPF regeneration cycle and limits exhaust flow while the electrical heater is heating to a predetermined soot combustion temperature

Diesel Engine System Design Qianfan Xin, 2011-05-26 Diesel Engine System Design links everything diesel engineers need to know about engine performance and system design in order for them to master all the essential topics quickly and to solve practical design problems Based on the author s unique experience in the field it enables engineers to come up with an appropriate specification at an early stage in

the product development cycle Links everything diesel engineers need to know about engine performance and system design featuring essential topics and techniques to solve practical design problems Focuses on engine performance and system integration including important approaches for modelling and analysis Explores fundamental concepts and generic techniques in diesel engine system design incorporating durability reliability and optimization theories Modeling and Analysis of Particulate Matter Deposition and Regeneration in a Diesel Particulate Filter Mengting Yu,2013 Diesel engines are widely used because of their high efficiency and low greenhouse gas emission The particulate matter PM emitted by a diesel engine is collected and then burned in a diesel particulate filter DPF Analysis and modeling works have been done in this research to provide insight on optimization of the DPF design and operating conditions to achieve low pressure drop across the filter to decrease fuel consumption and low peak temperature during regeneration to avoid filter melting cracking and or catalyst deactivation Limiting models of the 1 D two channel DPF model are analyzed Analytical predictions and physical insight on the filtration velocity pressure drop heat transfer light off and regeneration in a DPF are obtained The hydraulic analysis enables an efficient optimization of the DPF that lead to a more uniform PM deposition profile and a decrease of the pressure drop The heat transfer light off and regeneration analysis enable estimations of the DPF heat up time the speed and width of the temperature front the light off temperature and time and the peak regeneration temperature New DPF regeneration procedures are proposed to limit the maximum local temperature rise In various cases a DPF is connected by a wide angled cone diffuser to the engine exhaust pipe A 2 D axisymmetric PM deposition and regeneration model is developed to investigate the impact of the inlet cone on the deposition rate and the regeneration temperature as well as on the transient inlet velocity distribution among the various DPF channels The highest regeneration temperature and thermal stress when using an inlet cone may be quite higher than when it is absent A major technological challenge in the regeneration of the ceramic cordierite filter is that a sudden decrease of the engine load referred to as Drop to Idle DTI may create a transient temperature peak much higher than under either the initial or final stationary feed conditions This excessive transient temperature rise may cause local melting or cracking of the ceramic filter Suggestions on how to limit the peak temperature rise following a DTI are provided through numerous simulations of the 1 D and 2 D DPF regeneration models **Design and Development of Heavy Duty Diesel Engines** P. A. Lakshminarayanan,Avinash Kumar

Agarwal,2019-11-05 This book is intended to serve as a comprehensive reference on the design and development of diesel engines It talks about combustion and gas exchange processes with important references to emissions and fuel consumption and descriptions of the design of various parts of an engine its coolants and lubricants and emission control and optimization techniques Some of the topics covered are turbocharging and supercharging noise and vibrational control emission and combustion control and the future of heavy duty diesel engines This volume will be of interest to researchers and professionals working in this area **Loading and Regeneration Analysis of a Diesel Particulate Filter with a Radio**

Frequency-Based Sensor ,2010 Accurate knowledge of diesel particulate filter DPF loading is critical for robust and efficient operation of the combined engine exhaust aftertreatment system Furthermore upcoming on board diagnostics regulations require on board technologies to evaluate the status of the DPF This work describes the application of radio frequency RF based sensing techniques to accurately measure DPF soot levels and the spatial distribution of the accumulated material A 1.9L GM turbo diesel engine and a DPF with an RF sensor were studied Direct comparisons between the RF measurement and conventional pressure based methods were made Further analysis of the particulate matter loading rates was obtained with a mass based soot emission measurement instrument TEOM Comparison with pressure drop measurements show the RF technique is unaffected by exhaust flow variations and exhibits a high degree of sensitivity to DPF soot loading and good dynamic response Additional computational and experimental work further illustrates the spatial resolution of the RF measurements Based on the experimental results the RF technique shows significant promise for improving DPF control enabling optimization of the combined engine aftertreatment system for improved fuel economy and extended DPF service life

Passive Regeneration Michael James Bahr (Nav. E.),Massachusetts Institute of Technology. Department of Mechanical Engineering,2013 Diesel particulate filters DPF have seen widespread growth as an effective means for meeting increasingly rigorous particle emissions regulations There is growing interest to exploit passive regeneration of DPFs to reduce fuel consumption accompanying traditional active regeneration Incombustible material or ash mainly derived from metallic additives in the engine lubricant accumulates in the DPF over time This ash accumulation increases flow restriction and rise in pressure drop across the DPF The growth of pressure drop adversely impacts engine performance and fuel economy This study built upon previous research to evaluate the different effects of regeneration strategy on ash packing and distribution within DPFs Since passive regeneration relies on a catalyzed reaction the interactions of ash with the catalyst will play an important role Passive regeneration is specifically dependent on exhaust feed gas composition exhaust conditions including temperature and flow rate catalyst type and configuration and the state of DPF loading during prior to passive regeneration The goal of the study is to address the long term effects of regeneration parameters on ash accumulations and the resulting impact of ash on the DPF catalyst performance Experiments were conducted that focused on pressure drop measurements over the lifetime of diesel particulate filters with different regeneration methods coupled with post mortem ash characterization These experiments provide insight to how these regeneration methods impact the DPF performance These results among few fundamental data of this kind correlate changes in diesel particulate filter performance with exhaust conditions regeneration strategy and ash morphological characteristics Outcomes are useful in optimizing the design of the combined engine aftertreatment lubricant system for future diesel engines balancing the necessities of additives for adequate engine protection with the requirements for robust aftertreatment systems

Individual and Synergistic Effects of Lubricant Additive (Ca, Mg, Zn) Combinations on

Ash Characteristics and Diesel Particulate Filters Performance Casey Jianzhi Chiou, Massachusetts Institute of Technology. Department of Mechanical Engineering, 2013 Diesel particulate filters DPF are devices that trap hazardous particulate matter from diesel engine exhaust in order to meet increasingly strict particle emissions regulations Diesel exhaust particulates mainly include soot and ash Soot carbon particles derived from incomplete fuel combustion can be oxidized into carbon dioxide after being trapped by the DPF through a catalytic heating process called regeneration Ash however derived from metallic additives in the engine lubricant required for robust engine operation is an incombustible material and remains within the DPF following regeneration As ash accumulates over time exhaust airflow through the filter becomes restricted and an engine backpressure results Engine performance and fuel economy are reduced requiring the DPF to be cleaned or replaced While the detrimental effects of ash on DPF performance and therefore fuel economy can be illustrated and quantified there is much to be understood about the specific factors that govern ash properties like distribution permeability and morphology Several different parameters such as engine operating conditions and DPF design have been found to significantly impact ash characteristics and the ultimate goal is to be able to control these parameters to reduce detrimental ash effects to a minimum and improve DPF service life and performance This work addresses the source of ash directly and investigates the effect of lubricant additive chemistry on ash characteristics and DPF performance Three lubricant formulations that differ only in the type of additives present are tested and compared using a controlled accelerated DPF loading system Filter pressure drop response and resulting ash property data collected using an array of experimental and analytical techniques show that very little difference exists between the tested oils of differing additive content

Modeling and Interpreting the Observed Effects of Ash on Diesel Particulate Filter Performance and Regeneration Yujun Wang (Ph. D.), Massachusetts Institute of Technology. Department of Mechanical Engineering, 2014 Diesel particulate filters DPF are devices that physically capture diesel particulates to prevent their release to the atmosphere Diesel particulate filters have seen widespread use in on and off road applications as an effective means for meeting increasingly stringent particle emissions regulations Although the soot deposit can be removed by regeneration the incombustible material ash primarily derived from metallic additives in the engine lubricant accumulates in the DPF channels with the increasing vehicle mileage or equivalent running hours Ash accumulation inside filter increases the flow restriction and reduces the filter soot storage capacity which results in higher filter regeneration frequencies and larger engine fuel penalty Combined with experimental observations DPF models are built to investigate the fundamental mechanisms of DPF aging process The DPF soot and ash loading model based on porous media filtration theory is applied to understand the soot deposition across the substrate wall with soot and ash cake layer formation DPF models are also used to investigate the process of ash transport and catalyst deactivation with increasing ash load level DPF ash aging is found to have negative effect on passive regeneration due to the catalyst deactivation and diffusion resistance of ash cake layer Besides at given amount of ash load

the effects of ash spatial distribution on DPF performance are studied via simulation. It is found that the ash end plug has significant influences on DPF pressure drop while ash radial and axial distributions have minor effects. At known ash and substrate property, DPF performance can be optimized according to the sensitivity map developed from this study. DPF model is beneficial to interpret the experimental observations and it is applied to predict the effects of certain factors like flow rate and deposit level on DPF performance. At the same time, modeling results are useful in optimizing the design of the combined engine aftertreatment lubricant system for future diesel engines and in understanding the requirements for robust aftertreatment systems.

Modeling, Estimation and Control of Integrated Diesel Engine and Aftertreatment Systems

Pingen Chen, 2014. The application of modern Diesel engines in automotive industry has been widely recognized for reasons of their distinguished performances on fuel economy, durability and reliability. Meanwhile, NO_x and particulate matters (PM) emissions have been the main concerns in the evolution of Diesel engines as more and more stringent emission standards have been legislated against Diesel engine emissions worldwide. In addition, as the Greenhouse gas emissions are receiving more and more concerns due to global warming issues, the demand of fuel economy improvement is increasing significantly. The objective of this research is to develop systematic control methodologies based on fundamental insight into the system characteristics to improve the overall fuel economy and emission performance of integrated Diesel engine and aftertreatment systems. The test platform of this research is a medium duty Diesel engine equipped with high pressure common rail fuel injection system, dual loop exhaust gas recirculation system, variable geometry turbocharger system and an integrated aftertreatment system including a Diesel oxidation catalyst (DOC), Diesel particulate filter (DPF) and two catalyst selective catalytic reduction (SCR) system. The topics of this research fall into two groups. The first group focuses on the modeling, estimation and control of integrated aftertreatment systems based on the interactions between the subsystems with the objective of maintaining low tailpipe emissions at low cost. Topics covered in this group include the modeling and observer based estimations for oxygen concentration and thermal behaviors across the DOC and DPF, state estimator design for SCR system using production NO_x sensor measurements and the active NO/NO₂ ratio controller design for DOC and DPF to improve the SCR performance. The second group mainly concentrates on the modeling, estimation and control of integrated engine aftertreatment systems grounded on the interactions between engine and aftertreatment systems to simultaneously maintain high fuel efficiency and low tailpipe emissions. Topics contained in this group include the air fraction modeling and estimation for Diesel engines coupled with aftertreatment systems during normal operations and active DPF regenerations, control oriented thermal model for integrated Diesel engine and aftertreatment system, active thermal management and integrated Diesel engine and aftertreatment active NO_x emissions control for fuel economy improvement. The control oriented models, observers and controllers of integrated Diesel engine and aftertreatment systems proposed in this research when applied in automotive fields have potentials of improving the engine fuel efficiency, reliability and reducing tailpipe

emissions in systematic real time and cost effective manners **An Improved Visualization of Diesel Particulate Filter**
Kevin W. Boehm, Massachusetts Institute of Technology. Department of Mechanical Engineering, 2011 The prevalence of diesel particulate filters DPF is increasing as emissions standards worldwide evolve to match current technologies Since the first application of DPFs in the 1980 s PM trapping effectiveness has increased by orders of magnitude During the filter s use phase it is subject to multiple cycles of particulate matter trapping and regeneration The soot particles are combusted in the high temperatures however metal additives referred to as ash primarily from lubricants remain behind and restrict exhaust flow Further ash accumulation causes a pressure drop across the filter and necessitates replacement in order to maintain fuel economy and engine performance Research into more efficient DPF designs and geometries examines current limitations with the goal of emitting cleaning emissions and extending DPF use In order to gain a better understanding of PM trapping and regeneration and acquire real time feedback an improved visualization method of DPF is required For that method powder glass frit was applied between the filter and glass window and heated to form a bond After the heating process the bond strength was measured to determine optimal heating cycles and surface conditions for the glass seal The experimental results were examined to measure the success of the bonding method relative to previous research using alternative methods The ability to test and observe ash accumulation in different DPF designs will contribute to the understanding of PM trapping

Passively Regenerated Diesel Particulate Filter Performance on a Heavy-duty Disel Engine Jacob Curtis
Savstrom, 2004

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