

# Computer Simulation of Automotive Emission Control Systems

**Key developments in modelling of diesel emissions control components and catalysts are highlighted**

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Computer simulation has become an important tool for designing automotive emission control systems. This paper highlights some of the key developments made in modelling of diesel emissions control components and catalysts by Johnson Matthey. The general methodology for model development involves determination of the reaction kinetics using laboratory reactor data, followed by validation of the resulting model against vehicle or engine data. The development of models for diesel oxidation catalysts (DOCs), ammonia selective catalytic reduction (SCR) catalysts, lean nitrogen oxides (NO<sub>x</sub>) traps (LNTs) and diesel particulate filters (DPFs), including coated filters such as the SCR coated DPF (SCR<sup>®</sup>), is discussed.

A new methodology for developing models (or at least adapting existing models) using engine or vehicle data, which offers a faster route to a finished model, is also discussed. The use of this methodology to develop a DOC model capable of predicting the effect of platinum group metal (pgm) loading is presented; the model gives a good prediction of carbon monoxide, hydrocarbon (HC), NO<sub>x</sub> and nitrogen dioxide (NO<sub>2</sub>) over a vehicle test cycle for pgm loadings in the range 30 g ft<sup>-3</sup> to 120 g ft<sup>-3</sup>.

## 1. Introduction

Catalytic exhaust gas aftertreatment has considerably reduced the emissions from automotive sources since its introduction in the late 1970s (1–5). The progress made in developing improved aftertreatment catalysts and technologies has been complemented by the development of mathematical models (6, 7), which are used for designing aftertreatment systems and for improving understanding of the way these systems function; computer simulation offers a faster and more cost effective route for the system design than a purely experimental ‘trial and error’ process. This paper gives an overview of some of the work done at Johnson Matthey on developing models for computer simulation of aftertreatment systems.

Johnson Matthey has been working on computer simulation of emission control systems for more than 25 years. The original work used computational fluid

# Automotive Emission Control And Computer Systems

**Annelies Wilder-Smith**



## **Automotive Emission Control And Computer Systems:**

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**How To Use Automotive Diagnostic Scanners** Tracy Martin,2015-08-01 From hand held dedicated units to software that turns PCs and Palm Pilots into powerful diagnostic scanners auto enthusiasts today have a variety of methods available to make use of on board diagnostic systems And not only can they be used to diagnose operational faults they can be used as low budget data acquisition systems and dynamometers so you can maximize your vehicle s performance Beginning with why scanners are needed to work effectively on modern cars this book teaches you how to choose the right scanner for your application how to use the tool and what each code means How To Use Automotive Diagnostic Scanners is illustrated with photos and diagrams to help you understand OBD I and OBD II systems including CAN and the scanners that read the information they record Also included is a comprehensive list of codes and what they mean From catalytic converters and O2 sensors to emissions and automotive detective work this is the complete reference for keeping your vehicle EPA compliant and on the road      *Highway Safety Literature* ,1984

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*Energy Futures and Urban Air Pollution* Chinese Academy of Sciences,Chinese Academy of Engineering,National Research Council,National Academy of Engineering,Policy and Global Affairs,Development, Security, and Cooperation,Committee on Energy Futures and Air Pollution in Urban China and the United States,2008-02-22 The United States and China are the top two energy consumers in the world As a consequence they are also the top two emitters of numerous air pollutants which have local regional and global impacts Urbanization has led to serious air pollution problems in U S and Chinese cities although U S cities continues to face challenges the lessons they have learned in managing energy use and air quality are relevant to the Chinese experience This report summarizes current trends profiles two U S and two Chinese cities and recommends key actions to enable each country to continue to improve urban air quality **Popular Science** ,1979-08 Popular Science gives our readers the information and tools to improve their technology and their world The core belief that Popular Science and our readers share The future is going to be better and science and technology are the driving forces that will help make it better The Automotive Gray Market John B. Hege,2022-04-05 In the 1970s as car enthusiasts in the U S grew bored with models manufactured under tightening pollution and safety regulations some innovative dealers exploited a legal loophole designed to allow U S soldiers and diplomats to return from abroad with their vehicles to import exotic cars never intended for sale in America During the 1980s a rise in the value of the dollar made car shopping in Europe a bargain hunter s dream A network of unauthorized gray market importers and conversion shops emerged bypassing factory channels and retrofitting cars to meet U S regulations and emission standards at least in theory These cars had to pass through U S customs a system equipped to handle only a few independent imports annually As applications ballooned the regulatory system collapsed This is the story of a misunderstood but fascinating period in the automotive industry when creative importers found ways to put American motorists in new Ferraris while the EPA and DOT were backed up with mounds of paperwork Statistical Anaysis and Modeling of Automotive Emissions Timothy C. Coburn,2001-04 Contains many of the papers presented in a mini symposium on statistical analysis modeling of automotive emissions held in Aug 1999 The articles represent the efforts of approximately 20 authors co authors from across industry gov t academia cover a diverse array of topics regarding fundamental methodological issues advanced statistical techniques specific case studies Two papers included in the mini symposium involved the assessment of sulfur in diesel fuel on the performance of emissions control devices the forecasting of ozone standard exceedances that occur partly in response to vehicular traffic vol dispersion *USAF Formal Schools* United States. Dept. of the Air Force,1986 *Federal Register* ,1992-04-15 *Fundamentals of Automotive Technology* Vangelder,2017-02-24 Revised edition of Fundamentals of

automotive maintenance and light repair Kirk T VanGelder 2015      **Light and Heavy Vehicle Technology** M J Nunnery,2007-01-18 Light and Heavy Vehicle Technology Fourth Edition provides a complete text and reference to the design construction and operation of the many and varied components of modern motor vehicles including the knowledge needed to service and repair them This book provides incomparable coverage of both cars and heavier vehicles featuring over 1000 illustrations This new edition has been brought fully up to date with modern practices and designs whilst maintaining the information needed to deal with older vehicles Two entirely new sections of the book provide a topical introduction to alternative power sources and fuels and battery electric hybrid and fuel cell vehicles More information on the latest developments in fuel injection diesel engines and transmissions has also been added An expanded list of technical abbreviations now contains over 200 entries a useful resource for professional technicians in their day to day work This book is an essential textbook for all students of automotive engineering particularly on IMI C G 4000 series and BTEC courses and provides all the underpinning knowledge required for NVQs to level 3 By bridging the gap between basic and more advanced treatments of the subject it also acts as a useful source of information for experienced technicians and technically minded motorists and will help them to improve their knowledge and skills      *Fuel Economy: a Bibliography* Lois Flynn,1977      **A Subject Bibliography from Highway Safety Literature** United States. National Highway Traffic Safety Administration,1976      *Resources in Education* ,1984      **School Shop** ,1984

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contain  $6 \times 10^{23}$  particles atoms ions molecules

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