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Onboard Diagnostics and Measurement in the Automotive Industry, Shipbuilding, and Aircraft Construction

Michael Palocz-Andresen
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Preface

The first edition of this book was published in Germany by Expert Verlag in 2008. Since that time, the increase in technical intelligence in transportation has been an unstoppable process. In the last three years, government regulations regarding driving characteristics and combustion and exhaust-gas-treatment technologies have greatly expanded. Current requirements can only be fulfilled with the assistance of intelligent, onboard, microcontroller, microsensor, and microactuator systems.

In recent years, in addition to systems that measure engine and motor vehicle data, other subsystems for sustainability have been developed, such as remote sensing and data transfer technology. Complex traffic control systems also assume the existence of onboard intelligence.

The trends in many other sectors of sustainability resemble those in the area of transport. A U-turn to sustainable transportation with regard to fuel consumption is still a long way off. Meanwhile, increasing consumption of fuels eventually led to a multiplicity of complex problems, such as accelerated environmental and climate change. European Union legislation, specifically the EU 5 and EU 6 norms and the requirements for portable emission-measuring systems, support the direct monitoring of emissions.

This book describes technologies such as onboard diagnostics (OBD) and onboard measurement (OBM) and explains some of the applications that use these solutions. Combined OBD/OBM technology can optimize field-monitoring methods, inspection and maintenance measures, and exhaust-gas testing procedures. The benefits of combined OBD/OBM technology are not confined to its practical application but can also contribute to the use of sustainable driving behavior.

In shipping, development trends are similar to those in the field of heavy commercial vehicles. Data transfer to a center for sustainable shipping can contribute to the ecological design of harbor taxes.

In aviation, intelligent microsensors can help to lower the fuel consumption of aircraft engines. In areas surrounding airports, emission data serve to enable the introduction of the ecological design of airport taxes in the future, similar to sustainable harbor taxes.

It is hoped that this book will be used to stimulate further discussion for anyone who is interested in the fields of technology, sustainability, legislation, environmental and climate protection, and social and economic justice.

Lüneburg, winter 2011

Dr. Wolfgang Ruck
Abbreviations and Definitions

AAC  Alaska Marine Vessel Visible Emission Standard
ABT  averaging banking and trading
ANN  artificial neuronal network
Bin  the limiting value rate in the U.S. EPA
BSO  Lake Constance Shipping Ordinance
   (BSO = Bodenseeschifffahrtsordnung)
BTL  biomass-to-liquid
CAEP  Committee on Aviation Environmental Protection
CAN-Bus  controller area network-bus
CLD  chemo luminescence detection
CNG  compressed natural gas
CRT  continuously regenerating trap
CVS  constant volume sampling
DA  durability
DeNO$_X$  denitrification system
DTC  detection trouble codes
DTR  distronic
EC  European Commission
ECE  Economic Commission for Europe
ECU  engine control unit
EGAT  exhaust gas after treatment
EGR  exhaust gas recirculation
EOBD  European On-Board Diagnostics
EPA  U.S. Environmental Protection Agency
ESC  European stationary cycle
EU 4  European exhaust gas standard
EUDC  extra urban driving cycle
FID  flame ionization detector
FM  field monitoring
FTP  federal test procedure
GHG  greenhouse gas
GPS  Global Positioning System
GSM  Global System for Mobile Communications
GST  generic scan tool
GTL  gas-to-liquid
GVW  gross vehicle weight
HDV  heavy-duty vehicle
ICAO  International Civil Aviation Organization
IMO  International Maritime Organization
IPC  industrial personal computer
IPCC  International Panel for Climate Change
<table>
<thead>
<tr>
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<td>IR</td>
<td>infrared</td>
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<tr>
<td>IUC</td>
<td>in-use compliance</td>
</tr>
<tr>
<td>IUMPR</td>
<td>in-use monitor performance ratio</td>
</tr>
<tr>
<td>IUPR</td>
<td>in-use performance ratio</td>
</tr>
<tr>
<td>LCD</td>
<td>liquid crystal display</td>
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<tr>
<td>LEV</td>
<td>low-emission vehicle</td>
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<tr>
<td>LIDAR</td>
<td>light detection and ranging</td>
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<tr>
<td>LPG</td>
<td>liquefied petroleum gas</td>
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<tr>
<td>MC</td>
<td>microcontroller</td>
</tr>
<tr>
<td>MEPC</td>
<td>Maritime Environment Protection Committee</td>
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<tr>
<td>MFF</td>
<td>main function failure</td>
</tr>
<tr>
<td>MIL</td>
<td>malfunction indicator light</td>
</tr>
<tr>
<td>NDIR</td>
<td>nondispersive infrared radiation</td>
</tr>
<tr>
<td>NEDC</td>
<td>new European driving cycle</td>
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<td>OBD</td>
<td>onboard diagnostics</td>
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<td>OBM</td>
<td>onboard measurement</td>
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<td>ORM</td>
<td>on-road measurement</td>
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<tr>
<td>PEMS</td>
<td>portable emission measurement system</td>
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<tr>
<td>RTC</td>
<td>real-time clock</td>
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<td>SAE International</td>
<td>formerly, the Society of Automotive Engineers</td>
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<td>SCR</td>
<td>selective catalytic reduction</td>
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<tr>
<td>TA</td>
<td>type approval</td>
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<td>Tier 1</td>
<td>U.S. regulation of exhaust gases</td>
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<tr>
<td>VOEM</td>
<td>vehicle on-road-emission and energy measurement system</td>
</tr>
<tr>
<td>WHTC</td>
<td>worldwide heavy-duty transient cycle</td>
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<tr>
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<td>worldwide harmonized onboard diagnostic</td>
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