THE 12TH INTERNATIONAL CONFERENCE ON TURBOCHARGERS AND TURBOCHARGING

17–18 May 2016
The Kia Oval,
Surrey County Cricket Club,
London

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THE 12TH INTERNATIONAL CONFERENCE ON TURBOCHARGERS AND TURBOCHARGING


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Key Topics include:

- Novel applications
- Compressor design, matching, interaction, fuel cell applications, plus CFD
- Advanced simulation: 1D, heat transfer and multibody optimisation
- Transient response
- Supercharging, turbocompound, V/G and 2-Stage
- Novel applications: Euro 7, electric assist plus eBoosting and down-speeding
- Turbocharger gas stand and novel testing methods
- Materials, housing, burst containment, EGR
- Turbine; unsteady flow
- Turbine design, plus CFD
- Fatigue life
- Bearings, seals and rotodynamic design
- Exhaust waste heat recovery

This International Conference is the next in the Institution’s highly successful and prestigious series, held regularly since 1978, addressing current and novel aspects of turbocharging systems design, boosting solutions for engine downsizing and improvements in efficiency.

The current emission legislations and environmental trends for reducing CO$_2$ and fuel consumption are the major market forces in the land transport industry. The internal combustion engine is the key product and downsizing, efficiency and economy are the driving forces in development for both spark ignition (SI) and compression ignition (CI) engines in the passenger car and commercial vehicle applications.

Over 250 experts will come together to:

- Study advances in 1D simulation and validation
- Enhance systems’ transient response
- Learn ways to reduce turbine fatigue
- Find out about new methods to improve turbine unsteady flow

Don’t Miss
Exclusive drinks reception and three-course networking dinner after day one.

Limited places available, book your ticket when registering.

Media Partners

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# Programme

## Day 1  
**Tuesday 17 May**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session A: Compressor: Applications &amp; Matching</th>
<th>Session B: Gas Stand &amp; Novel Testing Methods</th>
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<tr>
<td>08:30</td>
<td>Registration and Refreshments</td>
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<tr>
<td>09:00</td>
<td>Chair’s Welcome &amp; Introduction</td>
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<td>09:10</td>
<td>Keynote Address</td>
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<td>Tomonori Niizato, Senior Chief Engineer, Technology Development Division 3, Automobile R&amp;D Centre, Honda R&amp;D</td>
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<tr>
<td>09:40</td>
<td>Turbocharger Compressor Map Enhancement for Highly Efficient Combustion Engines</td>
<td>The E-Drive: An Isentropic Compressor Performance Test Rig</td>
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<td>Tobias Czapka, Dirk Hagelstein, Joerg Theobald, Wolfgang Demmelbauer-Ebner, Volkswagen AG, Germany; Joerg Seume, Leibniz Universität Hannover, Germany</td>
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<td></td>
<td>DETERMINE THE ISENTROPIC TURBINE EFFICIENCY DUE TO ADIABATIC MEASUREMENTS, AND THE VALIDATION OF THE CONDITIONS VIA A NEW CRITERION</td>
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<td>Phillip Parma, Marco Bergmann, BorgWarner Turbo Systems, Germany</td>
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<tr>
<td>10:00</td>
<td>Aerodynamic Design of a High Flow and High Pressure Ratio Centrifugal Compressor for a Marine-Use Turbocharger</td>
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<td>Chihiro Mikami, Kiwamu Yamada, Tomoki Kawakubo, IHI Corporation, Japan</td>
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<td>AN APPROACH TO TURBINE HOUSING VALIDATION THROUGH THE MEASUREMENT OF RESIDUAL STRESS USING NEUTRON DIFFRACTION AND OPERATIONALLY INDUCED STRESSES USING HIGH TEMPERATURE STRAIN GAUGES</td>
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<td>Katy Gannon, Kiumars Shoghi, BorgWarner Turbo Systems, United Kingdom; Sue Kilcoyne, The University of Huddersfield, United Kingdom; Thilo Pirling, Institut Laue-Langevin, France; Shu-Yan Zhang, Rutherford Appleton Laboratory, United Kingdom</td>
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<td>10:50</td>
<td>Networking Refreshment Break</td>
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<tr>
<td>11:20</td>
<td>Investigation of Performance and Flow Mechanism of a Non-Axisymmetric Cas ing Treatment in Centrifugal Compressor for Turbochargers</td>
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<td>Baotong Wang, Ryusuke Numakura, Vehicle Turbocharger Operation, IHI Corporation, Japan; Hideaki Tamaki, Corporate Research &amp; Development, IHI Corporation, Japan</td>
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<td>BIDIRECTIONAL FLOW MEASUREMENT BASED ON THE DIFFERENTIAL PRESSURE METHOD FOR SURGE ANALYSIS ON A SMALL CENTRIFUGAL COMPRESSOR</td>
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<td>Moritz Werner, Roland Baar, Technische Universität Berlin, Germany; Peter Haluska, Ivo Sandor, Continental Automotive GmbH, Germany</td>
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<td>11:40</td>
<td>Global Optimisation of Recirculation Flow Type Casing Treatment in Centrifugal</td>
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<td>Daisaku Sakaguchi, Min Thaw Tun, Nagasaki University, Japan; Ryusuke Numakura, Baotong Wang, IHI Corporation, Japan</td>
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<td>COMPRESSOR INLET AND OUTLET PIPE LENGTH AND VOLUME, AND THE EFFECTS ON THE CHARACTERISTICS AND LOCATION OF SURGE</td>
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<td>Michael Whittlesea, Erling Roberts, Cummins Turbo Technologies, United Kingdom</td>
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<td>12:00</td>
<td>Q&amp;A Session with Morning Speakers</td>
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<td>12:40</td>
<td>Networking Lunch</td>
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</table>
SESSION 3A: SUPERCHARGING, TURBOCOMPOUND, V/G & 2-STAGE

13:50  AXIAL GROOVE CASING TREATMENT IN AN AUTOMOTIVE TURBOCHARGER CENTRIFUGAL COMPRESSOR
Peter Harley, Andre Starke, Takahiro Bamba, Dietmar Filsinger, IHI Charging Systems International GmbH, Germany

14:10  ULTRA-HIGH EFFICIENCY SERIAL TWO STAGE TURBOCHARGING SYSTEM FOR MAXIMUM ENGINE EFFICIENCY
Rob Cadle, Dietmar Giebert, Ashraf Mohamed, Ronren Gu, Matthew Oakes, Honeywell International, United States of America

14:30  VTG TURBOCHARGER EVOLUTION OF BORGWARNER TURBO SYSTEMS
Ralf Christmann, Ralf Kopietz, Nico Buhl, Hermann Breitbach, BorgWarner Turbo Systems, Germany

14:50  EXPERIMENTAL INVESTIGATION OF UPSTREAM INSTALLATION EFFECTS ON THE TURBOCHARGER COMPRESSOR MAP
Bertrand Kerres, Andreas Cronhjort, Department of Machine Design, KTH Royal Institute of Technology, Sweden; Mihai Mihaescu, Department of Mechanics, KTH Royal Institute of Technology, Sweden

15:10  INFLUENCE OF THE PIPING SYSTEM ON THE SURGE LINE OF A SMALL CENTRIFUGAL COMPRESSOR FOR AUTOMOTIVE APPLICATIONS
Christoph Schäfer, Ivo Sandor, Michael Klaus, Continental Automotive GmbH, Germany; Roland Baar, Technische Universität Berlin, Germany

Q&A SESSION WITH AFTERNOON SPEAKERS

SESSION 3B: COMPRESSOR: SURGE LINE MEASUREMENT AND INTERACTION

15:10  EXPERIMENTAL INVESTIGATION OF UPSTREAM INSTALLATION EFFECTS ON THE TURBOCHARGER COMPRESSOR MAP
Bertrand Kerres, Andreas Cronhjort, Department of Machine Design, KTH Royal Institute of Technology, Sweden; Mihai Mihaescu, Department of Mechanics, KTH Royal Institute of Technology, Sweden

15:30  INFLUENCE OF THE PIPING SYSTEM ON THE SURGE LINE OF A SMALL CENTRIFUGAL COMPRESSOR FOR AUTOMOTIVE APPLICATIONS
Christoph Schäfer, Ivo Sandor, Michael Klaus, Continental Automotive GmbH, Germany; Roland Baar, Technische Universität Berlin, Germany

Q&A SESSION WITH AFTERNOON SPEAKERS

SESSION 4: ADVANCED SIMULATION

15:40  OBTAINING BULK FLOW BASED HEAT TRANSFER COEFFICIENTS FOR THERMAL
Alihshan Karamavruc, Borg Warner, United States of America

16:00  THE EFFECT OF DIFFERENT NOZZLE CLEARANCE AT HUB AND SHROUD SIDE ON VARIABLE NOZZLE TURBINE PERFORMANCE
Xin Shi, Sinan Guo, Ben Zhao, Ce Yang and Chaochen Ma, Beijing Institute of Technology, China (PRO)

16:20  Q&A SESSION WITH AFTERNOON SPEAKERS

16:50  CHAIR’S CLOSING REMARKS

17:00  CLOSE OF DAY 1

19:00  CONFERENCE DRINKS RECEPTION AND NETWORKING DINNER
Join speakers and industry for an exclusive networking opportunity and a three course dinner with wine.
- Booking required. See booking form or visit www.imeche.org/turbo.
- Places offered on a first-come first-serve basis.

DAY 2  WEDNESDAY 18 MAY

08:30  REGISTRATION AND REFRESHMENTS

09:00  CHAIR’S OPENING REMARKS

09:10  KEYNOTE ADDRESS
Heijo Ölschlegel, Daimler AG

SESSION 5A: TURBINE; UNSTEADY FLOW

SESSION 5B: MATERIALS, HOUSING, BURST CONTAINMENT, EGR AND FATIGUE LIFE
<table>
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<th>Time</th>
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<tr>
<td>09:50</td>
<td><strong>The Development of a Novel Unsteady Flow Control Method: Controlling the Rotating Nozzle Ring</strong></td>
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<td>Kun Cao, Peter Newton, Flora Harminder, Rolf Sauerstein, Ferdinand Winkler,</td>
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<td>BorgWarner Turbo Systems Engineering, Imperial College London, United Kingdom</td>
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<td>10:10</td>
<td><strong>Dual Volute Turbocharger - The Next Generation of Pulse Optimised Turbines for Automotive Applications</strong></td>
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<td>Marc Gugau, Tom Heuer, Sascha Weiske, Rolf Sauerstein, Ferdinand Winkler,</td>
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<td>BorgWarner Turbo Systems Engineering GmbH, Germany</td>
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<td>10:30</td>
<td><strong>Analyses of Flow Structures of a Twin-Entry Volute Under Pulsatile Flows Conditions</strong></td>
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<td>Cerdoun Mahfoudh, Ecole Militaire Polytechnique, Algeria; Ghenaiet Adel, Faculty of Mechanical and</td>
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<td>Process Engineering, University of Sciences and Technology, Algeria</td>
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<td>10:50</td>
<td><strong>Explicit Dynamic Finite Element Simulation of Turbocharger Containment and Wheel Burst</strong></td>
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<td>Lin Wang, Mike Eastwood, Cummins Turbo Technologies, United Kingdom</td>
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<td>10:10</td>
<td><strong>An Improved Approach to HCF Development for Vaneless Turbine Stages</strong></td>
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<td>Christopher Wilkins, William Smith, Durga Gouravaraju, Wagner Magalhaes, Zdenek Neterda, Honeywell</td>
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<td>Turbo Technologies, United States of America</td>
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<td>11:10</td>
<td><strong>Network Services Refreshment Break</strong></td>
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<td>11:40</td>
<td><strong>Design of a Turbine-Generator Unit for Automobile ORC Application</strong></td>
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<td>Harald Kunte, Joerg Seume, Leibniz Universitaet Hannover, Germany</td>
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<td>11:40</td>
<td><strong>Development of a High Temperature Turbocharger for Heavy Duty Applications</strong></td>
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<td>Andrew Sullivan, Mike Eastwood, David Brown, Cummins Turbo Technologies, United Kingdom</td>
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<td>12:30</td>
<td><strong>Q&amp;A Session with Morning Speakers</strong></td>
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<td>12:30</td>
<td><strong>Q&amp;A Session with Morning Speakers</strong></td>
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<td>13:30</td>
<td><strong>Heat Flow in a Turbocharger Shaft and Its Impact on the Bearing System</strong></td>
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<td>Thorsten Kleine, Henning Ratz, Joerg Seume, Institute for Turbomachinery and Fluid-Dynamics,</td>
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<td>Leibniz Universitaet Hannover, Germany; Nils Lübbert, Aerzener Maschinenfabrik GmbH, Germany</td>
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<td>13:30</td>
<td>**Low Inertia Centrifugal Compressor Wheels: Influence of Backside Cavity on Aerodynamic Losses</td>
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<td>and Axial Forces</td>
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<td>Tore Fischer, Henning Raetz, Melf Peters, Joerg Seume; Institute of Turbomachinery and Fluid</td>
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<td>Dynamics, Leibniz Universitaet Hannover, Germany</td>
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<td>13:30</td>
<td><strong>Electrically Assisted Turbocharger Optimisation for a Heavy Duty Diesel Engine</strong></td>
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<td>Ahmed Rezk, Martin Jupp, University of Huddersfield, United Kingdom; Jeff Carter, BorgWarner</td>
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<td>Turbo Systems, United Kingdom</td>
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<td>14:10</td>
<td>**The Effect of Oil Film Instability on Power Losses Prediction of TurbochargerRotor-Fully</td>
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<td>Floating Ring Bearing System</td>
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<td>Liang Tian, Matthew Wakelin, Craig Lancaster, Martin Lindsay, Cummins Turbo Technologies, United</td>
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<td>14:10</td>
<td><strong>Q&amp;A Session with Afternoon Speakers</strong></td>
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<td><strong>Q&amp;A Session with Afternoon Speakers</strong></td>
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<td>14:10</td>
<td><strong>Networking Lunch</strong></td>
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<td>14:10</td>
<td><strong>Session 7A - Bearings, Seals &amp; Rotodynamic Design</strong></td>
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<td>14:10</td>
<td><strong>Session 7B: Novel Application: Euro 7 &amp; Electric Assist Plus Eboositing &amp; Down Speeding</strong></td>
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**Notes:**
- All sessions are held in the morning and afternoon blocks.
- The program includes a variety of presentations on turbocharger technology, including simulations, experimental analyses, and Q&A sessions.
14:30 Q&A SESSION WITH AFTERNOON SPEAKERS

14:50 NETWORKING REFRESHMENT BREAK

SESSION 8A: EXHAUST WASTE HEAT RECOVERY
A ROBUST AND VALID METHOD OF GAS FOIL BEARING PARAMETERS ESTIMATION: A MODEL ANCHORED ON EXPERIMENTAL DATA
Robert Hoffmann, Oliver Munz, Enrico Barth, Tomasz Pronobis, Robert Liebich, Technische Universität Berlin

SESSION 8B: NOVEL APPLICATION: EURO 7 & ELECTRIC ASSIST PLUS EBOOSTING & DOWN SPEEDING
DESIGN OF COMPRESSOR FOR ELECTRICALLY DECOUPLED TURBOCHARGER IN DOWNSIZED GASOLINE ENGINE BY 3D INVERSE DESIGN
Irfan Ghazaly, Mehrdad Zangeneh, University College London, United Kingdom

15:20 A ROBUST AND VALID METHOD OF GAS FOIL BEARING PARAMETERS ESTIMATION: A MODEL ANCHORED ON EXPERIMENTAL DATA
Robert Hoffmann, Oliver Munz, Enrico Barth, Tomasz Pronobis, Robert Liebich, Technische Universität Berlin

15:40 EVALUATION METHOD OF THE EXHAUST SYSTEM OF THE TURBOCHARGED DIESEL ENGINE BASED ON EXERGY AND ENTHALPY ANALYSES
Chaochen Ma, School of Mechanical Engineering, Beijing Institute of Technology, China; Liwei Sun, School of Mechanical Engineering, Beijing Institute of Technology, China and Automotive Engineering Institute, China; Na Fang, Dongfeng Automotive Engineering Research Institute Technical Centre, China

16:00 Q&A SESSION WITH AFTERNOON SPEAKERS

16:20 Q&A SESSION WITH AFTERNOON SPEAKERS

16:50 CLOSING REMARKS

17:00 CLOSE OF CONFERENCE

For the most up-to-date and detailed programme for the event, please visit www.imeche.org/turbo
• This programme is subject to change.
• The Institution is not responsible for the views or opinions expressed by individual speakers.

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Porsche Motorsport Team
Bernd Wietholt
Volkswagen AG
Andrew Banks
Ricardo
Dr Kian Banisoleiman
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**BOOKING FORM**

**EVENT CODE: C6231**

**EARLY BIRD ENDS 18 MARCH 2016**

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**REGISTRATION** Please complete in capitals.

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**FEES AND CHARGES** Please complete the appropriate box.

Registration fees include entry to the sessions, refreshments, lunch on both days and a copy of the event proceedings.

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**PAYMENT DETAILS**

Payment must accompany this registration form. Registration will be confirmed only on receipt of full payment.

**PLEASE INDICATE METHOD OF PAYMENT:**

- [ ] Cheque Cheques should be made payable to IMechE and crossed. Please note international delegates may pay only by credit card, BACS or banker’s draft. A copy of the draft must accompany this form. It is the delegate’s responsibility to pay any bank charges.

- [ ] Credit Card
  - Card type: [ ] Visa [ ] MasterCard (please note we do not accept American Express, Diners Club or Maestro)
  - Card No
  - Valid From / Expiry Date /
  - Name of Cardholder
  - Billing Address of Cardholder (if different from above)
  - Postcode
  - Amount to be Deducted
  - Signature

- [ ] BACS BACS bank transfers can be made to:
  - IMechE Current Account, NatWest Charing Cross Branch
  - Sort Code: 60-40-05
  - Swift Code: NWBKGGBL
  - Acc No: 00817787

- [ ] Invoice (UK residents only) Delegates wishing to be invoiced must provide an order number. If your company does not use order numbers please include a formal request for invoicing on your company’s letterhead. A charge of £10 + VAT will be made to cover additional administration costs. Invoices are payable on receipt and no alterations to these terms will be accepted.

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**FIVE WAYS TO BOOK**

1. **Online:**
   - www.imeche.org/turbo

2. **Email:**
   - eventenquiries@imeche.org

3. **Phone:**
   - +44 (0)20 7973 1258

4. **Post** completed booking form to:
   - **Event Registrations**
   - **Institution of Mechanical Engineers**
   - **1 Birdcage Walk**
   - **London SW1H 9JJ**

5. **Fax:**
   - +44 (0)20 7304 6845

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Please read the information listed below as each booking is subject to the Institution’s standard terms and conditions.

**CONDITIONS OF BOOKING**

Completed application forms should be returned to the address above, along with the correct payment. Attendance at the event will be confirmed on receipt of the full balance. All participants are advised to bring a copy of their confirmation with them on the day, to ensure the fastest possible entry.

**SPECIAL REQUIREMENTS**

Please inform us of any special requirements, ie dietary or access, on the relevant section of this form.

**CANCELLATION**

For a refund (minus £25 + VAT admin charge), cancellations must be received at least 14 days prior to the event. Replacement delegates are welcome at any time. The Institution reserves the right to cancel any event. In this case, the full fee will be refunded unless a mutually convenient transfer can be arranged. In the event that the Institution postpones an event for any reason and the delegate is unable or unwilling to attend on the rescheduled date, they will receive a full refund of the fee paid.

The Institution is not responsible for any loss or damage as a result of a substitution, alteration or cancellation/postponement of an event. The Institution shall assume no liability whatsoever if this event is cancelled, rescheduled or postponed due to a fortuitous event. Act of God, unforeseen occurrence or any other event that renders performance of this conference impracticable, illegal or impossible. For the purposes of this clause, a fortuitous event shall include, but not be limited to: war, fire, labour strike, extreme weather or other emergency.

Please note that while speakers and topics were confirmed at the time of publishing, circumstances beyond the control of the organisers may necessitate substitutions, alterations or cancellations of the speakers and/or topics. The Institution reserves the right to alter or modify the advertised speakers and/or topics if necessary without any liability to you whatsoever. Any substitutions or alterations will be updated on the event’s webpage as soon as possible.

**LIABILITY**

The organisers do not accept liability for any injuries or losses of any nature incurred by delegates and/or accompanying persons, nor for loss or damage to their luggage and/or personal belongings.

**VENUE:**

The Kia Oval
Surrey County Cricket Club
Kennington
London SE11 5SS

**ACCOMMODATION:**

The Institution of Mechanical Engineers will be arranging discounted hotel and accommodation rates in the vicinity of the venue. Please check the website or contact us for more details.

The Institution of Mechanical Engineers is a registered charity (no 206882) VAT No GB299930493.
We are the market leader among professional engineering bodies. We’ve been supporting engineers since 1847 and have 111,000 members in over 140 countries, working in the world’s most dynamic and important industries. Our comprehensive events programme brings you the latest research and best practice from industry and academia.

OTHER EVENTS TO LOOK FOR:

22 March 2016
The Studio, Birmingham
DEVELOPMENTS IN TRANSMISSION AND DRIVELINE TECHNOLOGY
Be part of the key industry seminar that will explore how driveline technology is evolving for all automotive markets and what the systems will deliver.

26 April 2016
One Birdcage Walk, London
FUTURE FUELS 2016: AUTOMOBILE, MARINE AND AVIATION
Future Fuels will give an overall perspective on the different choices for low carbon mobility, with a critical appraisal of their strengths and weaknesses.

21–22 September 2016
Coventry
INTERNATIONAL CONFERENCE ON VEHICLE AERODYNAMICS 2016: AERODYNAMICS BY DESIGN
The next conference in this proven and successful series will take place in 2016 and cover the full range of automotive aerodynamic concepts.

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MEMBERSHIP
Whether you’re a student, apprentice, graduate, qualified engineer or just have an interest in engineering, Institution membership offers the highest professional prestige. Professional registration is a valuable investment for any engineer who is serious about their career.

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GET INVOLVED
Whether you’re new to the profession or well established, volunteering is a great way to gain new skills, knowledge and experience. As an Ambassador you have the chance to represent your profession and give something back to the engineering community as well as inspiring the next generation.

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Continuing Professional Development (CPD)
Our online Career Developer tool can help you:
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• Record Download a record of your learning activities
• Review Reflect on your professional development

Register for Career Developer and get more from your career www.imeche.org/careerdeveloper

For tailored advice contact cpd@imeche.org

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