

# **IET Professional Development Course on Electric Traction Systems 2012**

**IET Seminar Digests 2012/14922**

**London, United Kingdom  
5-8 November 2012**

**ISBN: 978-1-62748-385-8**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2012) by the Institution of Engineering and Technology  
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Institution of Engineering and Technology  
at the address below.

Institution of Engineering and Technology  
P. O. Box 96  
Stevenage, Hertfordshire  
U.K. SG1 2SD

Phone: 01-441-438-767-328-328  
Fax: 01-441-438-767-328-375

[www.theiet.org](http://www.theiet.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>Overview of Electric Railway Systems and the Calculation of Train Performance</b> .....	1
<i>M. Chymera, C. J. Goodman</i>	
<b>Electric Railway Traction Systems and Techniques for Energy Saving</b> .....	19
<i>S. Hillmansen</i>	
<b>Overview of Signalling and Train Control Systems</b> .....	25
<i>E. Goddard</i>	
<b>Braking Systems and Their Control Architectures</b> .....	41
<i>A. L. Nicholas</i>	
<b>DC &amp; AA Traction Motors</b> .....	53
<i>T. J. Nicholson</i>	
<b>DC Motor Control</b> .....	67
<i>M. A. Shardlow, J. J. Greening</i>	
<b>Control of Induction Motors</b> .....	87
<i>A. Pankhurst</i>	
<b>Inverters</b> .....	97
<i>R. Faddoul, A. C. Lancaster</i>	
<b>AC/DC Railway Electrification and Protection</b> .....	139
<i>R. D. White</i>	
<b>EMC in Railways</b> .....	189
<i>C. A. Marshman</i>	
<b>Signalling and Telecommunication Compatibility Issues</b> .....	197
<i>C. Place</i>	
<b>Auxiliary Power Systems for Rolling Stock</b> .....	211
<i>G. Bolton</i>	
<b>On Board Train Control and Monitoring Systems</b> .....	223
<i>G. Neil</i>	
<b>Electric Contact Systems - Passing Power to the Trains</b> .....	247
<i>D. J. Hartland</i>	
<b>Risk Reduction for Software Based Railway Control Systems</b> .....	261
<i>P. J. Bryan</i>	
<b>Commissioning New Electrical Multiple Units</b> .....	293
<i>A. Armstrong</i>	
<b>Extending the Pendolino Trains</b> .....	303
<i>J. Evans</i>	
<b>Money to Burn - Making a Business Case for New Traction on 1980s EMUS</b> .....	309
<i>I. Walmsley</i>	
<b>Author Index</b>	