

53rd Annual Conference of the British Institute of Non-Destructive Testing

(NDT 2014)

**Manchester, United Kingdom
9-11 September 2014**

ISBN: 978-1-63439-503-8

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© (2014) by the British Institute of Non-Destructive Testing
All rights reserved.

Printed by Curran Associates, Inc. (2014)

For permission requests, please contact the British Institute of Non-Destructive Testing
at the address below.

British Institute of Non-Destructive Testing
Newton Building
St. George's Avenue
Northampton, NN2 6JB
United Kingdom

Phone: 44 0 1604 89 3811
Fax: 44 0 1604 89 3861

info@bindt.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
Web: www.proceedings.com

NDT 2014 Conference Topics - Tuesday 9th

09.20 Roy Sharpe prize lecture - A vision of ultrasonic guided wave NDT and SHM inspection potential

Author - Dr C Lissenden, Penn State University will present the opening plenary – Whitworth Suite

N/A

Session IA – Applications I

Chair: Dr R Edwards Whitworth Suite

10.45 Industrial production process control with advanced helix and cone beam computed tomography

Authors - O Brunke, R Evans and T Hemberger GE Measurement & Control

1

11.10 Development of the low-power and highly-sensitive GaAs 2DEG DC linear/unipolar Hall-effect integrated circuit

Authors - M Sadeghi and M Missous University of Manchester

2

11.35 Development of eddy current tangential transducers for inspection of threads of pump compressor and drill pipes

*Authors - V Syasko¹, P Solomenchuk¹ and A Polacek²
¹Constanta Ltd ²NDTI Kraft Ltd*

10

12.00 Inexpensive spatial position system for the improvement of manual ultrasound NDT

Authors - M A A Rashed, T P Sattar & O A Oumar London South Bank University

25

NDT 2014 Conference Topics - Tuesday 9th

Session IB – **NDT: Putting theory into practice**

Chair: **Mr J Hansen** Buckingham Suite

- 10.45** **Developing new-generation eddy current transducer (ECT) flaw detectors to meet client needs**
Author - J Hansen Ether NDE 45
- 11.10** **Ultrasonic guided wave mode conversion from transducer coupling**
Authors - P S Lowe^{1,2}, S Fateri^{1,2} and P Mudge¹
¹TWI Ltd Granta Park ²Brunel University S Fateri will present 46
- 11.35** **Eddy current array characterisation**
Authors - R Hughes University of Warwick 54
- 12.00** **The factors that affect the defect sizing capabilities of the magnetic flux leakage technique**
Authors - M Boat, N Pearson, R Lieb, J Davies, R James and B Woodhead
SilverwingUK LTD 55

NDT 2014 Conference Topics - Tuesday 9th

Session IC – Simulation

Chair: Em Prof J Gryzagoridis Palace 6

- 10.45 Validation of PZFlex for simulation of ultrasonic array imaging applications**
Authors - J Dobson, A Tweedie, G Harvey and A Gachagan University of Strathclyde 65
- 11.10 Simulation for the impact damage detection in composites by using near-field microwave waveguide imaging**
Authors - Z Li, A D Haigh, C Soutis and A A P Gibson University of Manchester 66
- 11.35 Ultrasonic simulation to design a high-frequency ultrasonic technique to inspect friction stir welded components**
*Authors - S Avramidis, D Yan, M Lindop and I Cooper
TWI Technology Centre (Wales)* 76
- 12.00 An implementation of rectangular infinite absorbing boundaries for acoustic simulation**
Authors - C Lee, G-M Zhang and D Harvey Liverpool John Moores University 88

NDT 2014 Conference Topics - Tuesday 9th

Session 2A – Applications 2

Chair: Prof S Dixon Whitworth Suite

14.00 Development of an ultrasonic inspection system to detect kissing bonds in friction stir welded components

Authors - D Yan¹, S Avramidis¹, D Liaptsis¹, M Lindop¹, I Cooper¹, S Michau²
A Nguyen-Dinh², J Hettler³, M Tabatabaeipour³, S Delrue³, KV D Abeele³
and F Perrier

¹TWI Technology Centre (Wales), ²Vermont SA and
³K.U.Leuven Campus Kortrijk

98

14.25 THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION

N/A

14.50 Automating lift-off compensation for the inspection of painted welds using single-probe eddy current testing technology

Authors - B Ward GE Measurement & Control

110

16.15 Incremental permeability and magnetic Barkhausen noise for the assessment of microstructural changes in Grade 91 power station tubes

Authors - J W Wilson¹, N Karimian¹, A J Peyton¹, J Liu², N Kahlon² and C L Davis²
¹University of Manchester ²University of Birmingham

111

NDT 2014 Conference Topics - Tuesday 9th

Session 2B – **Human elements of NDT**

Chair – **Dr I Baillie** Buckingham Suite

- 14.00** **EPSRC fellowships in performance and inspection**
Authors - D Smith EPSRC 123
- 14.25** **Socialising NDT – using connectivity technology to increase POD, decrease false calls and make faster decisions on indications**
Authors - B Ward GE Measurement & Control 124
- 14.50** **Parallel single-view multiplicative algebraic reconstruction technique for medical imaging**
Authors - M Bajpai¹, P Gupta² and P Munshi²
¹Indian Institute of Information Technology, Design & Manufacturing, Jabalpur
²Indian Institute of Technology Kanpur 125
- 16.15** **HOIS JIP experience in validation of techniques and personnel for advanced in-service inspection applications in the oil & gas industry**
Authors - S F Burch and H R Peramatzis ESR Technology 126

NDT 2014 Conference Topics - Tuesday 9th

Session 2C – Data processing and validation

Chair – Prof M Lowe Palace 6

- 14.00 A new phase diversity-based algorithm for ultrasonic array imaging of scattering materials in NDE**
Authors - R Gongzhang, A Gachagan and B Xiao University of Strathclyde 127
- 14.25 The effect of surface roughness on extrapolation from C-scan data using extreme value theory**
Authors - D Benstock and F Cegla Imperial College London 128
- 14.50 Towards a validation protocol for new NDT capabilities in the air domain**
Authors - A Ballisat¹, R Smith¹, D Hallam² and P Wilcox¹
¹University of Bristol ²Defence Science and Technology Laboratory
Porton Down 129
- 16.15 Validation of analytical methods for longitudinal and transverse dynamic response of a non-contact electromagnetic sensor on cylindrical metal samples**
Authors - N Karimian, Y Zhao, W Yin and A J Peyton
School of Electrical and Electronic Engineering, University of Manchester 130
- 16.40 Plenary Paper – Applications of electromagnetic inspection: from engineering materials to people screening to foodstuffs for academia and industry**
Author - A Peyton, Manchester University Whitworth Suite 137

NDT 2014 Conference Topics - Wednesday 10th

09.00 Plenary Paper: BINDT strategy and the NDT and CM communities
Author - C Sinclair, CEO of BINDT Whitworth Suite 138

09.15 Plenary Paper: The FSN racing car
Author - Mesha Potton, University of Northampton 139

Session 3A – Phased array I **Chair: Mr G Lockett Whitworth Suite**

09.55 Maximum array image resolution and its practical implications
Authors - A Croxford and P Wilcox University of Bristol 140

10.20 Small bore phased array UT (SBPAUT) – the importance of qualification and experience
Authors - S Adams Doosan Babcock 141

11.15 A fast and efficient ultrasonic array imaging software platform
Authors - T Lardner, J Dziewierz, A McGilp, A Prakash TK, R Gongzhang, B Xiao and A Gachagan University of Strathclyde 142

11.40 Non-linear ultrasonic array imaging of fatigue cracks
Authors - J Potter and A Croxford University of Bristol 143

12.05 Development and implementation of calibration process for full matrix capture
Authors - S Mosey, M Sutcliffe, M Weston, B Knight-Gregson and D Liaptis TWI Technology Centre (Wales) 144

NDT 2014 Conference Topics - Wednesday 10th

Session 3B – Composites I

Chair: Dr E A Birt Buckingham Suite

- | | | |
|-------|---|-----|
| 09.55 | X-ray computed tomography of composites <i>Authors - F Leonard, J Stein, M Gresil and C Soutis University of Manchester</i> | 154 |
| 10.20 | CT application in dimensional measuring delamination of CFRP caused by drilling <i>Author - N Kourra University of Warwick</i> | 157 |
| 11.15 | Relating NDT data to mechanical performance loss in impact-damaged composites <i>Authors - D Aylett¹, I Cooper¹ and J C Arnold² ¹TWI Technology Centre (Wales) ²Swansea University</i> | 158 |
| 11.40 | Use of 3D non-destructive characterisation for modelling the mechanical properties of as-manufactured composite components <i>Authors - L J Nelson, N Xie, R A Smith and S R Hallett Faculty of Engineering, University of Bristol</i> | 170 |
| 12.05 | THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION | N/A |

NDT 2014 Conference Topics - Wednesday 10th

Session 3C – Pipeline inspection

Chair: Dr B Fernandes Palace 6

- 09.55 AUT inspection of pipeline girth welds evaluating strengths and limitations of zonal discrimination approach**
Authors - R M Nardo¹ and K Seward²
¹NDT Engineer, AdES NDT Ltd ²Specialist NDT Engineer, Subsea 7 181
- 10.20 Differentiation of 3D scanners and their positioning method when applied to pipeline integrity**
Author - P H Allard and J A Lavoie Creaform 192
- 11.15 An assessment of mecanum wheels for non-destructive testing (NDT) applications**
Authors - W A Blyth^{1,2}, D R W Barr¹, N Hankinson¹ and F R Baena²
¹Phoenix Inspection Systems Ltd ²Imperial College London 202
- 11.40 Experimental study of A0 Lamb wave tomography on pipes**
Authors - M Seher, P Huthwaite, M J S Lowe and P Cawley
Imperial College London 214
- 12.05 Development of subsea radiography using a marinised DDA**
Authors - J R McNab¹, D Scoville¹, D Keck² and R Venkatachalam³
¹Oceaneering ²BP America Inc ³GE 215

NDT 2014 Conference Topics - Wednesday 10th

Session 3D – **BINDT** developments

Chair: **Mr S Lavender** and **Mr C Sinclair** **Palace 7**

- | | | |
|--------------|--|-----|
| 09.55 | Developments in personnel certification <i>Author - N Scutt BINDT</i> | 216 |
| 10.20 | BINDT/AINDT harmonisation <i>Authors - L Dick¹ and C Sinclair² ¹AINDT ²BINDT</i> | 217 |
| 11.15 | Developments in pathways to engineering registration <i>Authors - C Bull Chair, MQ&E Committee, BINDT</i> | 218 |
| 11.40 | PCN UT of corrosion <i>Author - S Lavender MBE Lavender International NDT</i> | 219 |
| 12.05 | Title to be confirmed <i>Author - R Lyon TBC</i> | 220 |

NDT 2014 Conference Topics - Wednesday 10th

Session 4A – Phased array 2

Chair: Dr A Gachagan Whitworth Suite

- | | | |
|-------|--|-----|
| 14.15 | Inspection of complex components using 2D arrays and TFM <i>Authors - A McGilp¹, T Lardner¹, J Dziejewicz¹, A Gachagan¹, J Mackersie¹ and C Bird²</i> <i>¹University of Strathclyde ²Doosan Babcock</i> | 221 |
| 14.40 | Near-surface defect characterisation using ultrasonic arrays <i>Author - P Yu, J Zhang, T Gang and BW Drinkwater University of Bristol</i> | 230 |
| 15.30 | A new state-of-the-art portable phased array ultrasonic technique <i>Authors - P Benoist¹, G Neau¹, F Cartier² and S Robert²</i> <i>¹M2M ²CEA</i> | 231 |
| 15.55 | Mechanised testing of solid rail axles with consideration of geometry influences using phased array <i>Authors - W Kleinert GE Measurement & Control</i> | 232 |
| 16.20 | An investigation of ultrasonic array performance for inspecting polycrystalline materials <i>Author - V Pamel^{1,2}, P Huthwaite¹, C Brett² and M Lowe¹</i> <i>¹Imperial College London ²E.ON Technologies (Ratcliffe) Limited</i> | 233 |
| 17.05 | The future for NDT is bright. Can we make it brighter? <i>Author - BA McGrath, AMEC Commercial Whitworth Suite</i> | 234 |
| 17.25 | President's Honour Lecture – NDT from the customer's perspective <i>Author - M Dowell, IMechE Whitworth Suite</i> | 335 |

NDT 2014 Conference Topics - Wednesday 10th

Session 4B – Composites 2

Chair: **TBC Buckingham Suite**

14.15 PAUT inspection of complex-shaped composite materials through 6 DOFs robotic manipulators

*Authors - B Wright¹, I Cooper¹, P I Nicholson¹ C Mineo² and S G Pierce²
¹TWI Technology Centre, Wales ²University of Strathclyde*

236

14.40 Methods for fibre-orientation characterisation in monolithic carbon-fibre composites

*Author - L J Nelson, C Fraij and R A Smith
Ultrasonics and NDT Group, University of Bristol*

248

15.30 Towards the 3D characterisation of GLARE and other fibre-metal laminate composites

*Authors - R A Smith¹, I A Veres² and V J Pinfield³
¹University of Bristol ²Research Center for Non-Destructive Testing GmbH
³Loughborough University*

263

15.55 In-service inspection – Typhoon / A400M / Dreamliner

Authors - Speaker to be confirmed

274

16.20 Portable wireless ultrasonic systems for remote inspection

Author - C Zhong and A Croxford and P Wilcox University of Bristol

275

NDT 2014 Conference Topics - Wednesday 10th

Session 4C – From theory to application

Chair: Prof K Newton Palace 6

- 14.15 RFID sensor system for detecting corrosion progression using transient responses**
Authors - A I Sunny, GYTian and M Alamin Newcastle University 276
- 14.40 Echo state network applications in structural health monitoring**
Author - A J Wootton, C R Day and P W Haycock Keele University 289
- 15.30 Non-destructive testing using shear horizontal (SH) ultrasound generated and detected by periodic permanent magnet electromagnetic acoustic transducers (PPM EMATs)**
Authors - P A Petcher, S E Burrows and S Dixon University of Warwick 301
- 15.55 Thermographic NDE advisory and guidance system**
Authors - D P Almond¹, S Angioni¹ and S G Pickering²
¹RCNDE ²University of Bath 302
- 16.20 Development of advanced ultrasonic technology for automatic solid axle defect detection**
Author - J Peng¹, C Peng¹, Y Zhang¹, B Zhao² and L Du²
¹Southwest Jiaotong University ²Chengdu Lead Science & Technology Co Ltd 303

NDT 2014 Conference Topics - Wednesday 10th

Session 4D – TBC

Chair: Dr S Burch Palace 7

- 14.15 Measurement of residual stresses in reactor components using X-ray technique**
*Authors - H N Singh, P Mishra and V P Jathar
Post Irradiation Examination Division, Bhabha Atomic Research Centre,
Mumbai* 310
- 14.40 Electrodynamic flexural ultrasound transducers**
Author - T J R Eriksson, S M Dixon and S N Ramadas University of Warwick 311
- 15.30 Speckle reduction in ultrasound non-destructive evaluation of coarse-grained material using a statistical estimation method**
*Authors - B Xiao, R Gongzhang, T Lardner, R L O'Leary and A Gachagan
University of Strathclyde* 312
- 15.55 Defect detection in ferromagnetic aircraft parts using hybrid EMAT and eddy current sensor**
*Authors - S Thomas¹, O Ubadike¹ and E C Ashigwuike²
¹Air Force Institute of Technology, Optimizing Local Engineering,
Nigerian Airforce Base ²Brunel University* 313
- 16.20 Eddy current array probe for crack detection and sizing in carbon steel welds**
*Author - L Beaulieu-Charbonneau, M Sirois, S Parmentier, N Decourcelle
and M Grenier Eddyfi NDT Inc
A Greenbank will present* 321

NDT 2014 Conference Topics - Thursday 11th

09.15 Plenary Paper - Ultrasonic structural health monitoring: an overview

Author - M Gresil¹, V Giurgiutiu² and C Soutis¹

¹University of Manchester, ²University of South Carolina Whitworth Suite 335

Session 5A – Modelling I

Chair: Dr R Chapman Whitworth Suite

09.45 Modelling grain-scattered ultrasound in austenitic stainless steel welds: a hybrid model

Author - O Nowers Rolls-Royce Marine University of Bristol

347

10.10 Ultrasonic modelling of coarse-grained austenitic steel

*Authors - S Avramidis, M Weston and D Liaptsis
TWI Technology Centre (Wales)*

348

10.35 Utilising non-destructive inspection information for damage tolerance evaluation of composite structures

Authors - S Giannis¹, V Matěják¹ and R Freemantle²

¹Element Materials Technology ²Wavelength NDT Ltd

359

NDT 2014 Conference Topics - Thursday 11th

Session 5B – Composites 3

Chair: Dr C Brett Buckingham Suite

09.45 Advancements in non-destructive testing of wind rotor blades

Author - SA Nielsen¹ and M Troedsson²

¹Sensor and NDE Innovation, Force Technology

²Wind Energy Business Development

360

10.10 On the equivalent flexural rigidity of sandwich composite panels

Authors - J Gryzagoridis¹, G Oliver¹ and D Findeis²

¹Cape Peninsula University of Technology ²University of Cape Town

370

10.35 Damage characterisation in composite materials under buckling test using acoustic emission waveform clustering technique

Authors - S Kh Al-Jumaili^{1,2}, M J Eaton¹, K M Holford¹, J P McCrory¹ and R Pullin¹

¹Cardiff University ²University of Basrah, Engineering College

377

NDT 2014 Conference Topics - Thursday 11th

Session 5C – Applications 3

Chair: **Chair: Mr N Harrap Palace 6**

09.45 Development and validation of an automated ultrasonic system for the non-destructive evaluation of welded joints in thermoplastic storage tanks

Author - M Spicer, F Hagglund and M Troughton TWI Ltd, Cambridge

387

10.10 Matching layers for a waveguide ultrasonic transducer for flow measurement in hostile environments

*Authors - M Laws¹, S N Ramadas² and S Dixon¹
¹University of Warwick ²Elster NV/SA, Essen*

399

10.35 Ultrasonic wall-loss monitoring of rough surfaces

Authors - A Gajdacs and F Cegla Imperial College London

400

NDT 2014 Conference Topics - Thursday 11th

Session 6A – Modelling 2

Chair: Dr B Chapman Whitworth Suite

- | | | |
|-------|--|-----|
| 11.15 | An estimation method for ultrasonic defect echo signal energy of inside wall longitudinal defect detection of pipes with small diameter and thick wall <i>Authors - H Sun, S Zhou, L Cui, D Xiao and C Xu Beijing Institute of Technology</i> | 401 |
| 11.40 | Selection/rejection of projection datasets obtained from a micro CT scanner for tomographic reconstruction <i>Authors - M Bajpai¹, T P Singh² and P Munshi² ¹Department of Computer Science & Engineering, Indian Institute of Information Technology Jabalpur ²Nuclear Engineering & Technology Programme, Indian Institute of Technology Kanpur</i> | 402 |
| 12.05 | THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION | N/A |
| 12.30 | Plenary Paper – Computer vision in X-ray testing <i>Author - D Mery, Department of Computer Science, Universidad Catolica de Chile Whitworth Suite</i> | 403 |

NDT 2014 Conference Topics - Thursday 11th

Session 6B – Applications

Chair: Dr C Brett Buckingham Suite

11.15 THIS SLOT IS AVAILABLE FOR A LATE SUBMISSION

PDE

11.40 **Measurement of compressive strength and rebar parameters of reinforced concrete in buildings in Nairobi, Kenya**

Authors - W M Kairu¹, M M Gatari¹, D M Maina¹, M L Muia² and J K Birir¹

¹Institute of Nuclear Science and Technology, University of Nairobi

²Technical University of Kenya

404

12.05 **Characterisation of acoustic emissions from mechanical seals for fault detection**

Authors - H Towsyfyhan, O Hassin, F Gu and A Ball University of Huddersfield

413

NDT 2014 Conference Topics - Thursday 11th

Session 6C – **Ultrasonic applications**

Chair: **Mr N Harrap** **Palace 6**

- | | | |
|-------|---|-----|
| 11.15 | Guided wave EMATs for the detection of corrosion in pipelines <i>Authors - M Clough, P Petcher and S Dixon University of Warwick</i> | 425 |
| 11.40 | Use of non-linear ultrasonic guided waves for early damage detection <i>Authors - Y Liu, C J Lissenden and J L Rose The Pennsylvania State University</i> | 435 |
| 12.05 | Quantitative simulation of ultrasonic and EMAT arrays using FEM and FDTD <i>Authors - Y Xie, W Yin and A Peyton University of Manchester</i> | 447 |

NDT 2014 Conference Topics

Roy Sharpe Prize Lecture

09.20 Roy Sharpe prize lecture - A vision of ultrasonic guided wave NDT and SHM inspection potential

*Author - Dr C Lissenden, Penn State University will present the opening plenary –
Whitworth Suite*

N/A