Peter Cawley CV

Professor Peter Cawley

Date of Birth: 25 Nov 1953

Address: Department of Mechanical Engineering, Imperial College, London SW7 2AZ

Nationality: British

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Academic Qualifications

BSc in Mechanical Engineering with First Class Honours, University of Bristol, June 1975.

PhD, Department of Mechanical Engineering, University of Bristol, Jan 1979. Location of defects in structures from vibration measurements.

Diploma in Teaching and Course Development in Higher Education with distinction, Institute of Education, University of London, June 1986. (Course taken part-time, 1984-1986.)

Membership of Professional Bodies

Fellow, Royal Society
Fellow, Royal Academy of Engineering
Fellow, Institution of Mechanical Engineers; Chartered Engineer
Member, British Institute of Non Destructive Testing
Member, American Society for Non Destructive Testing
Member, IEEE
Associate Editor, Structural Health Monitoring

Major Awards

Roy Sharpe Prize for significant contribution through research and development in NDT to the benefit of industry or society, Brit Inst NDT, 1998
Elected fellow Royal Academy of Engineering (UK National Engineering Academy), 2006
Societe Francaise d'Acoustique, Medaille Etrangere, 2006. (Medal for acoustics research, with MJS Lowe)
Structural Health Monitoring Lifetime Achievement award sponsored by Boeing and awarded at IWSHM, 2007
Elected fellow Royal Society (UK National Science Academy), 2010
Keynote lectures at World Conference on NDT Durban, 2012 and Seoul, 2020
Röntgen Award 2012 (with MJS Lowe) for major contribution to science and technology of NDT
NDE Lifetime Achievement Award from SPIE, 2013

Present Posts

Professor of Mechanical Engineering and Associate Dean for Enterprise in Engineering, Imperial College

Director, Guided Ultrasonics Ltd - spinout company formed to market ultrasonic guided wave technique for long range inspection and monitoring of pipes and other structures developed in research group

Chairman, Cognition Energy Ltd – spinout company formed in 2018 from research group in Mech Eng department to develop batteries for applications in demanding environments

Director, Rheon Labs Ltd – spinout company from Mech Eng department to provide impact protection and energy control in sports, PPE, medical and defence markets.

Previous Employment:

1978-79: research assistant, University of Bristol;
1979-81: vibration engineer, Lucas CAV;
1981-2019: Lecturer; Senior Lecturer (1989); Reader (1992); Professor (1996), Dept Mechanical Engineering, Imperial College.
2012-2019 Head of Imperial College Mechanical Engineering Department
2009-2016 Chairman Permasense Ltd – spinout company formed to market wireless ultrasonic thickness monitoring system developed in research group. Company acquired by Emerson Inc, 2016.
1999-2009 Director Integration Diagnostics Ltd – spinout company formed to market test for stability of dental implants. Acquired by Swedish investors; now trading as Osstell Ltd.

Research Highlights

Formed NDE Group on arrival at Imperial College in 1981. Activity in field started with PhD in 1979 on the use of vibration measurements to detect and locate damage in structures.

Over 200 refereed journal publications in the field; Scopus h index 67; >19,000 citations

Over 40 PhD graduates in NDE

Led the Imperial College NDE research group 1981-2019. Currently comprises two full professors, a reader and senior lecturer (associate professors), ~25 PhD students, EngD students and postdocs. The group was awarded an EPSRC platform grant in 2000 in recognition of its international reputation and potential for further development and the grant was renewed in 2005 and again in 2010. Professor Cawley is the lead academic in the EPSRC-industry funded UK Research Centre in NDE (RCNDE) that was launched in 2003 and has been renewed until 2020. The Centre is based at Imperial College; full industrial members include Rolls-Royce, Nuclear Decommissioning Authority, Airbus, Shell, BAE Systems, AMEC Foster Wheeler, BP, EDF, SKF, Tenaris, Hitachi, HSE and dstl. Over £50M research funding raised from government and industry.

The driving motivation of Professor Cawley's work is to solve real industrial inspection problems, achieved by conducting thorough scientific research. His work spans fundamental scientific studies through to the transfer of technology to industry. He collaborates and consults with numerous industrial partners, and technology he has developed is now being exploited by three spin-out companies, and through two other licence agreements.

Major Contributions

- Use of measurements of natural frequency changes in multiple modes of vibration to locate the position of the defect in a structure, and also to obtain a rough estimate of its size [3 – 1166 citations on Scopus][0].
- Application of natural frequency measurements to monitor integration of dental implants [68 – 542 citations]. This led to formation of Integration Diagnostics Ltd (now Osstell www.osstell.com)
- Comprehensive understanding of sensitivity of local vibration measurements for detection of delaminations in composite materials and disbonds in adhesive joints [eg 22 – 94 citations]
- Understanding of guided wave interaction with defects [eg 44 – 778 citations; 81 - 275 citations]
- 2D FFT method for decomposing multi-mode guided wave signals [39 – 663 citations]

[0] Numbers in parentheses refer to list of papers at end of document, followed by Scopus citations at 29 Dec 2019

- Practical application of guided wave measurements to inspection of pipes and rail [104 - 235 citations]. This led to formation of Guided Ultrasonics Ltd (www.guided-ultrasonics.com) and licence to Plant Integrity Ltd (Teletest) other companies.
- Practical low frequency guided wave transduction [63 – 200 citations]
- Guidelines for optimization of guided wave inspection [45 – 284 citations]
- Synthetic focusing of guided wave signals to produce C-scan image of a pipe [140 – 83 citations]
- Use of waveguide for high temperature thickness measurements [157 – 84 citations]. This led to formation of Permasense Ltd (Now Emerson) (www.emerson.com/en-us/automation/measurement-instrumentation/corrosion-erosion-monitoring/about-rosemount-wireless-corrosion-erosion-monitoring)
- Sensitivity of eddy current thermography [168 – 74 citations]
- Methodology for evaluation of sensitivity of guided wave monitoring systems [190 – 17 citations]

Commercial Exploitation in NDE and SHM

Two of the three spinout companies formed from Professor Cawley's research group are in the NDE/SHM field:

Guided Ultrasonics Ltd Formed 1999

The commercial implementation of Imperial guided wave research on pipe inspection has resulted in guided wave inspection being established as a new non-destructive evaluation (NDE) method. It is used worldwide to screen long lengths of pipework for corrosion, particularly in the petrochemical industry. The company currently employs eight PhD graduates in NDE from Imperial. Turnover on equipment sales in last decade exceeds £100M (by Guided Ultrasonics Ltd and via licence to other companies) and the service companies using the equipment generate about £75M pa in revenue worldwide and employ about 300 FTE staff to carry out the inspection. The oil companies benefit from greatly reduced cost of inspection, especially in areas such as insulated, offshore and buried pipes where access is difficult and expensive for conventional inspection methods. Furthermore, the reliability of inspection is significantly improved, leading to major improvements in safety.

Permasense Ltd. Formed 2009

Corrosion costs the oil and gas industry ~$8bn pa in the USA alone. Concern about its impact on plant-life limits the operator's ability to take advantage of lower cost, but more corrosive, feedstocks. The industry wanted to be able to monitor corrosion in real time with data transmitted directly to the plant control room. Two novel monitoring systems were developed in the NDE group, one for high temperatures up to 600^0C and the other for temperatures up to ~300^0C but with ability to operate through coatings. Permasense Ltd was formed to market the systems and >20,000 sensors are now deployed in over 200 sites (including more than 135 refineries, 33 upstream sites and several other industry applications) worldwide yielding revenues of ~£100M over the last decade and also providing economic benefits in the high 100s $M per annum to the oil and gas industry via, inter alia, the ability to process cheaper, more corrosive feedstocks safely, and reduced use of inhibitor chemicals. The company employs >40 staff in UK and was acquired by Emerson Inc for £32.4M in 2016.

Refereed Journal Publications

1. Adams, R.D., Cawley, P., Pye, C.J. and Stone, B.J. 'A vibration technique for non-destructively assessing the integrity of structures', J. Mechanical Engineering Science, Vol 20, pp93-100, 1978
2. Cawley, P. and Adams, R.D. 'The predicted and experimental natural modes of free-free CFRP plates', J. Composite Materials, Vol 12, pp336-347, 1978
3. Cawley, P. and Adams, R.D. 'The location of defects in structures from measurements of natural frequencies', J. Strain Analysis, Vol 14, pp49-57, 1979
4. Cawley, P. and Adams, R.D. 'A vibration technique for non-destructive testing of fibre composite structures', J. Composite Materials, Vol 13, pp161-175, 1979
5. Cawley, P. and Adams, R.D. 'Improved frequency resolution from transient tests with short record lengths', J. Sound and Vibration, Vol 64, pp123-132, 1979

6. Brownjohn, J.M.W., Steele, G.H., Cawley, P. and Adams, R.D. 'Errors in mechanical impedance data obtained with impedance heads', J. Sound and Vibration, Vol 73, pp461-468, 1980
7. Cawley, P., Adams, R.D. and Plumbridge, W.J. 'The use of vibration measurements for the detection of diffuse creep damage', J. Strain Analysis, Vol 16, pp37-41, 1981
8. Cawley, P. 'The reduction of bias error in transfer function estimates using FFT based analysers', ASME J. Vibration, Acoustics, Stress and Reliability in Design, Vol 106, pp29-35, 1984
9. Cawley, P. 'The impedance method of non-destructive inspection', NDT International, Vol 17, pp59-65, 1984
10. Cawley, P., Woolfrey, A.M. and Adams, R.D. 'Natural frequency measurements for production quality control of fibre composites', Composites, Vol 16, pp23-27, 1985
11. Cawley, P. 'The operation of impedance instruments based on the impedance method', J. Composite Structures, Vol 3, pp215-228, 1985
12. Cawley, P. 'Non-destructive testing of mass produced components by natural frequency measurements', Proc I Mech E, Vol 199, Part B, pp161-168, 1985
13. Cawley, P. 'The accuracy of frequency response function measurements using FFT based analysers with transient excitation', ASME J. Vibration, Acoustics, Stress and Reliability in Design, Vol 108, pp44-49, 1986
14. Guyott, C.C.H., Cawley, P. and Adams, R.D. 'The non-destructive testing of adhesively bonded structure: a review', J. Adhesion, Vol 20, pp129-159, 198615. Cawley, P. and Rigner, L.G. 'Rapid measurement of modal properties using FFT analysers with random excitation', ASME J. Vibration, Acoustics, Stress and Reliability in Design, Vol 108, pp394-398, 1986
16. Guyott, C.C.H., Cawley, P. and Adams, R.D. 'Vibration characteristics of the Mk II Fokker Bond Tester probe', Ultrasonics, Vol 24, pp318-324, 1986
17. Guyott, C.C.H., Cawley, P. and Adams, R.D. 'Use of the Fokker Bond Tester on joints with varying adhesive thickness', Proc I Mech E, Vol 201, part B, pp41-49, 1987
18. Cawley, P. 'Rapid production quality control by vibration measurements', Materials Evaluation, Vol 45, pp564-568, 1987
19. Cawley, P. and Clayton, D.L.R. 'A Vibration Technique for the Measurement of Contact Stiffness', Mechanical Systems and Signal Processing, Vol 1, pp273-283, 1987
20. Cawley, P. 'The Sensitivity of the Mechanical Impedance Method of Non-Destructive Testing', NDT International, Vol 20, pp209-215, 1987
21. Cawley, P. and Sarsentis, N. 'A Quick Method for the Measurement of Structural Damping', Mechanical Systems and Signal Processing, Vol 2, pp39-47, 1988
22. Cawley, P. and Adams, R.D. 'The Mechanics of the Coin-Tap Method of Non-Destructive Testing', J. Sound and Vibration, Vol 122, pp299-316, 1988
23. Guyott, C.C.H. and Cawley, P. 'The Measurement of Through Thickness Plate Vibration Using a Pulsed Ultrasonic Transducer', J. Acoustical Society of America, Vol 83, pp623-631, 1988
24. Guyott, C.C.H. and Cawley, P. 'The Ultrasonic Vibration Characteristics of Adhesive Joints', J. Acoustical Society of America, Vol 83, pp632-640, 1988
25. Adams, R.D. and Cawley, P. 'A review of defect types and nondestructive testing techniques for composites and bonded joints', NDT International, Vol 21, pp208-222, 1988
26. Guyott, C.C.H. and Cawley, P. 'Evaluation of the Cohesive Properties of Adhesive Joints Using Ultrasonic Spectroscopy', NDT International, Vol 21, pp233-240, 1988
27. Cawley, P. and Ray, R. 'A Comarison of the Natural Frequency Changes Produced by Cracks and Slots', ASME J. Vibration, Acoustics, Stress and Reliability in Design, Vol 110, pp366-370, 1988
28. Cawley, P. and Nguyen, D. 'The Use of the Impedance Method of Non-Destructive Testing on Honeycomb Structures', Mechanical Systems and Signal Processing, Vol 2, pp309-325, 1988
29. Cawley, P. 'The Introduction of a Problem-Based Option into a Conventional Engineering Degree Course', Studies in Higher Education, Vol 14, No 1, pp83-95, 1989
30. Cawley, P. 'The Effectiveness of Engineering Degree Courses', Assessment and Evaluation in Higher Education, Vol 14, pp228-241, 1989
31. Cawley, P. 'Is Laboratory Teaching Effective?', Int J Mechanical Engineering Education, Vol17, pp15-27, 1989
32. Cawley, P. and Theodorakopoulos, C. 'The Membrane Resonance Method of Non-Destructive Testing', J. Sound and Vibration, Vol 130, pp299-311, 1989
33. Cawley, P. and Adams, R.D. 'The Sensitivity of the Coin-Tap Method of Non-Destructive Testing', Materials Evaluation, Vol 47, pp558-563, 1989
34. Cawley, P. 'The Sensitivity of an NDT Instrument Based on the Membrane Resonance Method', NDT International, Vol 22, pp209-216, 1989
35. Pialucha, T., Guyott, C.C.H. and Cawley, P. 'Amplitude Spectrum Method for the Measurement of Phase Velocity', Ultrasonics, Vol 27, pp270-279, 1989
36. Cawley, P. 'A High Frequency Coin-Tap Method of Non-Destructive Testing', Mechanical Systems and Signal Processing, Vol 5, pp1-11, 1991

37. Cawley, P. 'The detection of delaminations using flexural waves', NDT International, Vol 23, pp207-213, 1990
38. Cawley, P. 'Low frequency NDT techniques for the detection of disbonds and delaminations', Brit J NDT, Vol 32, pp454-461, 1990
39. Alleyne, D.N. and Cawley, P. 'A 2-dimensional Fourier transform method for the measurement of propagating multi-mode signals', J Acoust Soc Am, Vol 89, pp1159-1168, 1991
40. Guo, N.Q. and Cawley, P. 'The transient response of piezoelectric discs to applied voltage pulses', Ultrasonics, Vol 29, pp208-217, 1991
41. Dewen, P.N., Pialucha, T.P. and Cawley, P. 'Improving the resolution of ultrasonic echoes from thin bondlines using cepstral processing', J. Adhesion Sci and Tech, Vol 5, pp667-689, 1991
42. Guo, N.Q. and Cawley, P. 'The finite element analysis of the vibration characteristics of piezoelectric discs', J Sound and Vibration, Vol 159, pp115-138, 1992
43. Adams, R.D., Brownjohn, J.M.W. and Cawley, P. 'The detection of defects in GRP lattice structures by vibration measurements', NDT & E International, Vol 24, pp123-134, 1991
44. Alleyne, D.N. and Cawley, P. 'The interaction of Lamb waves with defects', IEEE Trans Ultrasonics, Ferroelectrics and Frequency Control, Vol 39, pp381-397, 1992
45. Alleyne, D.N. and Cawley, P. 'Optimisation of Lamb wave inspection techniques', NDT&E International, Vol 25, pp11-22, 1992
46. Dewen, P.N. and Cawley, P. 'The practical application of ultrasonic spectroscopy for the measurement of the cohesive properties of adhesive joints', NDT&E International, Vol 25, pp65-75, 1992
47. Guo, N.Q. and Cawley, P. 'Measurement and prediction of the frequency spectrum of piezoelectric discs by modal analysis', J Acoust Soc Am, Vol 92, pp3379-3388, 1992
48. Alleyne, D.N., Pialucha, T.P. and Cawley, P. 'A signal regeneration technique for long range propagation of dispersive Lamb waves', Ultrasonics, Vol 31, pp201-204, 1993
49. Dewen, P.N. and Cawley, P. 'Cohesive property determination in bonded joints with composite adherends', Measurement, Vol 11, pp361-379, 1993
50. Dewen, P.N. and Cawley, P. 'Ultrasonic determination of the cohesive properties of bonded joints by measurement of reflection coefficient and bondline transit time', J Adhesion, Vol 40, pp207-227, 1993
51. Guo, N. and Cawley, P. 'The interaction of Lamb waves with delaminations in composite laminates', J Acoust Soc Am, Vol 94, pp2240-2246, 1993
52. Guo, N. and Cawley, P. 'Lamb wave propagation in composite laminates and its relationship with acoust-ultrasonics', NDT&E International, Vol 26, pp75-84, 1993
53. Guo, N. and Cawley, P. "Lamb wave reflection for the quick NDE of large composite laminates', Materials Evaluation, Vol 52, pp404-411, 1994
54. Cawley, P. 'The rapid nondestructive inspection of large composite structures', Composites, Vol 25, pp351-357, 1994
55. Drinkwater, B.W. and Cawley, P. 'An ultrasonic wheel probe alternative to liquid coupling', Insight (formerly Brit J NDT), Vol 36, pp430-433, 1994
56. Guo, N. and Cawley, P. 'The non-destructive assessment of porosity in composite repairs', Composites, Vol 25, pp842-850, 1994
57. Pialucha, T.P. and Cawley, P. 'An investigation of the accuracy of oblique incidence ultrasonic reflection coefficient measurements', J Acoust Soc Am, Vol 96, pp1651-1660, 1994
58. Pialucha, T.P. and Cawley, P. 'The detection of thin embedded layers using normal incidence ultrasound', Ultrasonics, Vol 32, pp431-440, 1994
59. Lowe, M.J.S. and Cawley, P. 'The applicability of plate wave techniques for the inspection of adhesive and diffusion bonded joints', J. NDE, Vol 13, pp185-200, 1994
60. Lowe, M.J.S. and Cawley, P. 'Comparison of the modal properties of a stiff layer embedded in a solid medium with the minima of the plane wave reflection coefficient', J. Acoust Soc Am, Vol 97, pp1625-1637, 1995
61. Lowe, M.J.S. and Cawley, P. 'The influence of the modal properties of a stiff layer embedded in a solid medium on the field generated by a finite sized transducer', J. Acoust Soc Am, Vol 97, pp1638-1649, 1995
62. Sklar, Z., Briggs, G.A.D., Cawley, P. and Kinloch, A.J. 'Quantitative acoustic microscopy of anodised and coated aluminium at frequencies up to 1 GHz', J. Mat Sci, Vol 30, pp3752-3760, 1995
63. Alleyne, D.N. and Cawley, P. 'The excitation of Lamb waves in pipes using dry coupled piezoelectric transducers', J NDE, Vol 15, pp11-20, 1996
64. Cawley, P., Pialucha, T.P. and Zeller, B.D. 'The characterisation of oxide layers in adhesive joints using ultrasonic reflection measurements', Proc Royal Soc Lond, Series A, Vol 452, pp1903-1926, 1996
65. Alleyne, D.N. and Cawley, P. 'The effect of discontinuities on the long range propagation of Lamb waves in pipes', Proc I Mech E, Part E: Journal of Process Mechanical Engineering, Vol 210, pp217-226, 1996

66. Drinkwater, B.W., Dwyer-Joyce, R.S. and Cawley, P. 'A study of the interaction between ultrasound and a partially contacting solid-solid interface', Proc Royal Soc Lond, Series A, Vol 452, pp2613-2628, 1996
67. Castaings, M. and Cawley, P. 'The generation, propagation and detection of Lamb waves in plates using air-coupled ultrasonic transducers', J. Acoust Soc Am, Vol 100, pp3070-3077, 1996
68. Meredith, N., Alleyne, D.N. and Cawley, P. 'Quantitative determination of the stability of the implant-tissue interface using resonance frequency analysis', Clin Oral Impl Res, Vol 7, pp261-267, 1996
69. Meredith, N., Shagaldi, F., Alleyne, D.N., Sennerby, L. and Cawley, P. 'The application of resonance frequency measurements to study the stability of titanium implants in the rabbit tibia', Clin Oral Impl Res, Vol.8, pp.234-243, 1997
70. Drinkwater, B.W. and Cawley, P. 'The practical application of solid coupled ultrasonic transducers', Materials Evaluation, Vol 55, pp401-406, 1997
71. Alleyne, D.N. and Cawley, P. 'Long range propagation of Lamb waves in chemical plant pipework', Materials Evaluation, Vol 55, pp504-508, 1997
72. Cawley, P. and Hosten, B. 'The use of large ultrasonic transducers to improve transmission coefficient measurements on viscoelastic anisotropic plates', J Acoust Soc Am, Vol 101, pp1373-1379, 1997
73. Zinin, P., Lefeuvre, O., Briggs, G.A.D., Zeller, B.D., Cawley, P., Kinloch, A.J. and Thompson, G.E. 'Anomalous behaviour of leaky surface waves for stiffening layer near cutoff', J Applied Physics, Vol 82, pp1031-1035, 1997
74. Drinkwater, B.W. and Cawley, P. 'Measurement of the frequency dependence of the ultrasonic reflection coefficient from thin interface layers and partially contacting interfaces', Ultrasonics, Vol 35, pp479-488, 1997
75. Monkhouse, R.S.C., Wilcox, P.D. and Cawley, P. 'Flexible interdigital PVDF transducers for the generation of Lamb waves in structures', Ultrasonics, Vol 35, pp489-498, 1997
76. Drinkwater, B.W., Dwyer-Joyce, R. and Cawley, P. 'A study of the transmission of ultrasound across solid-rubber interfaces', J Acoust Soc Am, Vol 101, pp970-981, 1997
77. Wilcox, P.D., Monkhouse, R.S.C., Cawley, P., Lowe, M.J.S. and Auld, B.A. 'Development of a computer model for an ultrasonic polymer film transducer system', NDT&E International, Vol 31, pp51-64, 1998
78. Castaings, M., Cawley, P., Farlow, R. and Hayward, G. 'Single sided inspection of composites using air coupled ultrasound', J NDE, Vol 17, pp37-45, 1998
79. Cawley, P., Pavlakovic, B., Alleyne, D.N., George, R., Back, T., Meredith, N. 'The design of a vibration transducer to monitor the integrity of dental implants', Proc I Mech E, Vol 212, Part H, pp265-272, 1998
80. Chan, C.W. and Cawley, P. 'Lamb waves in highly attenuative plastic plates', J Acoust Soc Am, Vol 104, pp874-881, 1998
81. Alleyne, D.N., Lowe, M.J.S. and Cawley, P. 'The reflection of guided waves from circumferential notches in pipes', ASME J Applied Mechanics, Vol 65, pp635-641, 1998
82. Lowe, M.J.S., Alleyne, D.N. and Cawley, P. 'The mode conversion of a guided wave by a part-circumferential notch in a pipe', ASME J Applied Mechanics, Vol 65, pp649-656, 1998
83. Wilcox, P.D., Cawley, P. and Lowe, M.J.S. 'Acoustic fields from PVDF interdigital transducers', IEE Proc Science, Measurement and Technology, Vol 145, pp250-259 1998
84. Zinin, P., Lefeuvre, O., Briggs, G.A.D., Zeller, B.D., Cawley, P., Kinloch, A.J., Zhou, X. and Thompson, G.E. 'Determination of density and elastic constants of a thin PAA oxide film by acoustic microscopy', J Acoust Soc Am, Vol 106, pp2560-2567, 1999
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86. Evans, M.J. and Cawley, P. 'Measurement and prediction of diffuse fields in structures', J. Acoust Soc Am, Vol 106, pp3348-3361, 1999
87. Wilcox, P.D., Dalton, R.P., Lowe, M.J.S. and Cawley, P. 'Mode and transducer selection for long range Lamb wave inspection', Key Engineering Materials, Vol 167, pp152-161, 1999
88. Evans, M.J., Webster, J.R. and Cawley, P. 'Design of a self calibrating simulated acoustic emission source', Ultrasonics, Vol 37, pp589-594, 2000
89. Monkhouse, R.S.C., Wilcox, P.D., Lowe, M.J.S., Dalton, R.P. and Cawley, P 'The rapid monitoring of structures using interdigital Lamb wave transducers', Smart Material and Structures, Vol 9, pp304-309, 2000
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93. Dalton, R.P., Cawley, P. and Lowe, M.J.S. 'Propagation of acoustic emission signals in metallic fuselage structure', IEE Proc Science, Measurement and Technology, Vol 148, pp169-177, 2001.

94. Dalton, R.P., Cawley, P. and Lowe, M.J.S. 'The potential of guided waves for monitoring large areas of metallic aircraft fuselage structure', J. NDE, Vol 20, pp29-46, 2001
95. Pavlakovic, B.N., Lowe, M.J.S. and Cawley, P. 'High frequency low loss ultrasonic modes in imbedded bars', ASME J Applied Mechanics, Vol 68, pp67-75, 2001
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97. Vine, K., Cawley, P. and Kinloch, A.J. 'The correlation of non-destructive measurements and toughness changes in adhesive joints during environmental attack', J Adhesion, Vol 77, pp125-161, 2001
98. Beard, M.D., Lowe, M.J.S. and Cawley, P. 'Development of a guided wave inspection technique for rock bolts', Insight, Vol 44, pp19-24, 2002
99. Vine, K., Cawley, P. and Kinloch, A.J. 'Comparison of normal and oblique incidence ultrasonic measurements for the detection of environmental degradation of adhesive joints', NDT&E International, Vol 35, pp241-253, 2002
100. Lowe, MJS, Cawley, P, Kao, J-Y and Diligent, O 'The low frequency reflection characteristics of the fundamental antisymmetric Lamb wave a_0 from a rectangular notch in a plate', J Acoust Soc Am, Vol 112, pp2612-2622, 2002
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102. Alleyne, D.N., Pavlakovic, B., Lowe, M.J.S. and Cawley, P. 'The use of guided waves for rapid screening of chemical plant pipework', J Korean Soc Nondestructive Testing, Vol 22, pp589-598, 2002
103. Cawley, P., Lowe, M.J.S., Simonetti, F., Chevalier, C. and Roosenbrand, A.G. 'The variation of the reflection coefficient of extensional guided waves in pipes from defects as a function of defect depth, axial extent, circumferential extent and frequency', Proc I Mech E, Part C, J Mech Eng Sci, Vol 216, pp1131-1143, 2002
104. Cawley, P., Lowe, M.J.S., Alleyne, D.N., Pavlakovic, B. and Wilcox, P. 'Practical long range guided wave inspection - applications to pipes and rail', Materials Evaluation, Vol 61, pp66-74, 2003
105. Vogt, T., Lowe, M.J.S. and Cawley, P. 'The scattering of guided waves in partly embedded cylindrical structures', J Acoust Soc Am, Vol 113, pp1258-1272, 2003
106. Allin, J.M. and Cawley, P. 'design and construction of a wideband non-resonant transducer', Ultrasonics, Vol 41, pp147-155, 2003
107. Demma, A., Cawley, P. and Lowe, M.J.S. 'Scattering of the fundamental shear horizontal mode from steps and notches in plates', J Acoust Soc Am, Vol 113, pp1880-1891, 2003
108. Beard, M.D., Lowe, M.J.S. and Cawley, P. 'Ultrasonic guided waves for inspection of grouted tendons and bolts' ASCE J Materials in Civil Engineering, Vol 15, pp212-218, 2003
109. Wilcox, P., Evans, M., Pavlakovic, B., Alleyne, D., Vine, K., Cawley, P. and Lowe, M. 'Guided wave testing of rail', Insight, Vol 45, pp413-420, 2003
110. Simonetti, F. and Cawley, P. 'A guided wave technique for the characterization of highly attenuative viscoelastic materials', J Acoust Soc Am, Vol 114, pp158-165, 2003
111. Allin, J.M., Cawley, P. and Lowe, M.J.S. 'Adhesive disbond detection of automotive components using first mode ultrasonic resonance', NDT&E International, Vol 36, pp503-514, 2003
112. Long, R.S., Cawley, P. and Lowe, M.J.S. 'Acoustic wave propagation in buried iron water pipes', Proc Royal Soc Lond: Mathematical, Physical and Engineering Sciences, Vol 459, pp2749-2770, 2003
113. Demma, A., Cawley, P. and Lowe, M.J.S. ' The reflection of the fundamental torsional mode from cracks and notches in pipes', J Acoust Soc Am, Vol 114, pp611-625, 2003
114. Vogt, T., Lowe, M.J.S. and Cawley, P. 'Cure monitoring using ultrasonic guided waves in wires', J Acoust Soc Am, Vol 114, pp1303-1313, 2003
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