Quality, Reliability and Maintenance - an opportunity to exchange expertise in thermal imaging between industry and medicine

Roderick A Thomas

QRM Mission

QRM is an organisation that organises Biennial Condition Monitoring Conferences at St Edmund Hall, University of Oxford. Established by Professor G J McNulty (University of Southampton, University of Sheffield and Sheffield Hallam). The first conference was organised at Clare College Cambridge in 1995 and since then at St Edmund Hall, Oxford. The QRM Conference Series has developed and flourished since the inaugural meeting in 1995 into well-established biennial meetings at the University of Oxford.

The interdisciplinary nature of QRM is exemplified by the 41 papers published in the current proceedings of the 6th International QRM conference held at St Edmund Hall, University of Oxford March 2007. Headings include, Quality Management, Reliability Analysis, Medical Thermography, Condition Monitoring techniques, Research Applications, and Computer Modeling. The material gathered in these proceedings rates some of the best of current practice and research in QRM, which is published in the hardback volume by Coxmoor Ltd, Oxford and has the seal of approval of the co-sponsors The Institution of Engineering and Technology (IET).

The aim of the conference in Quality Reliability and Maintenance (QRM) is to provide a forum of excellence so that the latest research findings can be open to scrutiny from both their peers and specialised international referees. Successful acceptance of the participants' work will be published in the book of proceedings (1,2). The proceedings were originally published by the Institution of Mechanical Engineers (IMechE). The IMechE distributes the proceedings world wide to Universities Libraries and research institutions. Published papers were predominately electrical, electronic and computer based applications

In 2004 Dr RAThomas CEng, FIEE, became conference organiser and is keen to continue to promote the integration of disciplines by widening access and the recent move of the IEE to IET fits perfectly the mission of QRM

A further objective is to keep costs low so that research workers, scientists and engineers of limited means can publish their research. The conference organisation therefore depends on voluntary professional personnel. In this way overheads are kept to a minimum.

Publications

Publications are rated highly in the priorities of these conferences. QRM endeavours to help research workers and research students to have their work exposed to international scrutiny. Papers are restricted to one author for every registration. However, in exceptional circumstances where an author has a further paper with excellent referees' reports, the paper may be deemed a possibility for inclusion in the QRM proceedings at a modest funding cost along with the author's first paper. The condition is that the authors of the extra paper must be from third world or new developing countries.

QRM proceeding papers are accepted for several leading international journals (3,4,5). Appropriate papers are published as special editions in the journals after presentation at QRM.

Previous conferences have been successful both in numbers and academic excellence, the latest proceedings is the 6th in the series representing a total to date of 369 papers from 21 nations. QRM encourages many aspects of condition monitoring particularly infrared thermography mainly industrial but there is a growing number of joint industrial/medical projects. Examples of research areas include:

- Infrared Thermography
- Vibration Analysis and digital Fourier Transforms
- Integrated approaches to Condition Monitoring
- Computation analysis in Condition Monitoring
- Non-Destructive Testing
- Education, Training, Standards and Competences

QRM 2007

Six papers have been selected, two medical and four industrial representing the latest in infrared developments. Greg McIntosh reviews generic methodologies for application of infrared thermography focusing on the methodology for conducting the inspection with an infrared imager and post inspection image analysis (6). Although this approach starts from industrial use of infrared images, the generic principles are also applicable in medicine and biology. My own paper is dealing with industrial applications of infrared thermography in more detail (7), discussing the advantages and disdvantages of infrared imaging as diagnostic condition monitoring technique. John Snell proposes a practical methodology for the evaluation of electrical systems with infrared thermography (8). His approach based on credibility of temperature measurements (which must be both accurate and precise) is combined with two levels of diagnostic questions, which lead to reliable diagnosis and prediction of the actual condition of the system investigated. The final paper from the industrial section reports the findings in evaluation of defects in automotive windscreens using photoelastic stress and thermographic measurements (9).

In the medical section, Kevin Howell and collegues review their experience with infrared imaging in the evaluation of diseases characterised by microcirulatory changes (10). The paper from the Anglo-Polish Database Group analyses clearly factors and procedures, which lead if left uncontrolled to serious errors and misinterpretation of thermal images in medicine (11).

In conclusion, it is quite obvious that thermographers in the field of industry and maintenance, but also in applications in medicine or biology face similar problems Thermal images just provide a two-dimensional map of temperature distribution on the surface of the object of interest. However, any procedure leading to accurate and precise temperature data will allow a correct assessment of the condition imaged if carefully matched with other sources of information. In medicine, diagnosis cannot be solely based on thermal images. The same statement is true for the condition assessment in maintenance of electrical systems (8). However, information on temperature levels of the subject/object evaluated, facilitates the decisions for procedures which may counteract or improve the condition under evaluation.

The quality of papers in the current volume of QRM2007 is in line with the high standards and technical content, which is a tradition of the QRM conferences. They reflect the rapid changes in technology together with the demands for Quality standards from governments and international bodies. The wide spectrum of interests reflects the all embracing and unique message inherent in the QRM philosophy.

References

1. McNulty (eds.); QRM 2000. Third international conference on Quality Reliability & Maintenance (Oxford, 3/30/2000), Professional Engineering publishing Limited, London, 2000

2-McNulty GJ (ed.): Proceedings of the 5th International Conference on "quality, Reliability and Maintenance" (QRM 2004), 1-2. April 2004, Oxford, UK (IMechE, Institution of Mechanical Engineers, UK). Trowbridge, Wiltshire, UK: Cromwell Press, 2004.

3. Bartelmus W.: Mathematical Modelling of Gearbox Vibration for Fault Diagnosis, International Journal of COMADEM, 2000 .3(4) 5-15

4. Cristofolini I., Mancuso G., Wolf G.Forecasting defective quality trends. Measurement and Control, 2001, 3 (4): 103-104.

5. Mitchell L, McNulty J. Quality, reliability and maintenance. Manufacturing Engineer, 2002, 81 (4):. 147

6. McIntosh GB. Generic methodologies for utilizing infrared thermography. Thermol int. 2007, 17:.91-93

7. Thomas R. Industrial applications of infrared thermography. Thermol int. 2007, 17:.94-99

8. Snell J. A practical, effective methodology for evaluating findings from thermographic inspections of electrical systems. Thermol int. 2007, 17:107-109

9. Donne KE, Thomas RD, Davies C, Calvert G. Photoelastic Stress and thermographic measurements of automotive windscreen defects generated by projectile impact. Thermol int. 2007, 17:.110-113

10. Howell KJ, Dziadzio M, Smith RE.Thermography in the microvascular laboratory.Thermol int. 2007, 17:.100-102

11. Ring FJ, Ammer K, Wiecek B, Plassmann P, Jones CD, Jung A, Murawski P.Quality assurance for thermal imaging systems in medicine..Thermol int. 2007, 17: 103-106

Address for correspondence

Dr Roderick A. Thomas
SnellInfrared International, Tyn-y-Coed, Glynhir Road,
Swan sea, SA4 8PX, UK

Email: rthomas@snellinternational.com

Quality, Reliability and Maintenance - An opportunity to exchange expertise in thermal imaging between industry and medicine. SU Repository: https://cronfa.swan.ac.uk/Record/cronfa40995. Maldague, X., Thomas, R., Donne, K., Clement, M., Kiernan, M., & Rozlosnik, A. (2002).Â Condition monitoring thermal properties of a 20A hydraulic-magnetic MCB. In Proceedings of the 31st International Congress and Exhibition on Condition Monitoring and Diagnostic Engineering Management (COMADEM) (pp. 79-88). Proceedings of the 31st International Congress and Exhibition on Condition Monitoring and Diagnostic Engineering Management (COMADEM), 2-5 July 2018. Medical equipment maintenance. Performing an audit to improve efficiency and savings. March 4, 2015.Â While a full-time imaging maintenance technician might not be economically beneficial at a single location, for instance, it might save money for multiple facilities when utilized as a shared resource. If this is impractical, facilities professionals can look at the ability of a single outsourced vendor to perform maintenance and repair on all specialized equipment for a discounted rate.Â In addition to labor hours saved, moving to predictive or reliability-centered maintenance will prevent equipment failure, optimize reliability and save costs.Â Facilities professionals should look at the mean time between diagnostic adjustment or repair and the mean time before failure. Modern Technologies in Medicine. Technology touches every aspect of the modern world. In all spheres of our life technological advances can change the way things work. In the field of medicine technological breakthroughs seem to be happening all the time.Â Unfortunately, while technology has produced an enormous number of benefits for mankind, it has also led to a number of new problems and woes in the modern world. Symptoms of everyday aches and pains are now considered to be symptoms of disease because technology has made medical knowledge more widespread. In addition, technology is more of a crutch for modern health care, convincing people to solve their woes through pharmacology rather than through more traditional or natural methods. The historical development of standards for medical thermal imaging in Europe, Northern America and the Far East is reported. Few studies were found in the literature which studied normal temperature values in selected body regions or focused on the symmetry of temperature distribution on the body surface. Reliabilty or reproducibility of temperature readings from infrared images was not investigated until the Nineties of the 20th Century. However, possible measurement errors due to oblique views on an object were identified in the Nineteen-Seventies.Â Quality, Reliability and Maintenance - An opportunity to exchange expertise in thermal imaging betwe January 2002 Â· Thermology International. Roderick A Thomas.