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*NDT&E International*, Vol. 29, No. 1, pp. 53–68, 1996
Elsevier Science Ltd
Printed in Great Britain

# NDT abstracts

NDT Abstracts are compiled by AEA Technology National NDT Centre, Harwell, Oxon, OX11 0RA, UK. The entries are drawn from over 500 British and International publications. Each issue concentrates on one or two subject areas.

The subjects covered in previous issues from February 1993 onwards are:
**Acoustic and ultrasonic measurement of elastic constants** – 27(1); **Acoustic emission testing of pressure vessels** – 26(6); **Bridge inspection** – 28(6); **Condition monitoring using acoustic and thermal techniques** – 27(4); **Eddy current probes** – 28(4); **Magnetic flux leakage** – 26(1); **Microwave NDT** – 27(6); **NDT in railways** – 26(4); **NDT using backscatter of ultrasound** – 26(5); **NDT using Compton scattering** – 28(3); **Positron annihilation** – 27(5); **Radar inspection in civil engineering** – 28(5); **Synthetic aperture signal processing** – 26(3); **Thermography of composites** – 26(2); **Ultrasonic NDE of aircraft** – 27(3); **X-ray tomography** – 27(2)

## Neural networks in ultrasonic and acoustic testing

58991 *Siores, E.; Seeto, T.*
**Categorizing acoustic emission signals using self organising maps**
Non-Destructive Testing – Australia, Vol. 32, No. 4, pp. 98-104 (Jul.– Aug. 1995)

This paper addresses the use of artificial neural networks for recognising and categorising acoustic emissions obtained during monitoring gear box failures. In particular, self-organising maps were employed to classify acoustic emission signatures representing gear box failures and identify their causes.

58871 *Han, W.; Birkeland, R.*
**Log scanning through combination of ultrasonics and artificial intelligence**
Proceedings of the 8th Symposium on the Nondestructive Testing of Wood, Vancouver, Washington (United States), 23-25 Sep. 1991. pp. 163-187. Conferences and Institutes Washington State University (1992)

This paper presents research work on development of a log scanning system for the use of softwood sawmills. This system scans logs by the means of ultrasound and artificial intelligence (AI). Through AI techniques, defects are characterized by a scheme of learning-assisted wavepattern recognition and a procedure of total information reasoning. Besides, AI functions are used to improve the efficiency or the quality of signal acquisition and processing. The newly developed scanning method seems to improve scanning efficiency. The result of defect characterization of a cross-section is compared with the results obtained by X-ray tomography. Good agreement is observed.

58863 *Murakami, R-i.; Shimada, Y.; Ueda, S.*
**Development of expert system for estimation of weld flaws by ultrasonic testing**
JSME International Journal, A. Vol. 37, No. 4, pp. 389-395 (1994)

The development of an expert system for ultrasonic testing(UT) can contribute to the improvement and standardization of inspection levels if the technique and experience of the UT engineer can be incorporated into a knowledge data base. It is considered that such an expert system will be one way to solve the problem of the predicted shortage of UT engineers in the near future. The present system was originally developed as a system having a knowledge-based system and an inference engine which are combined with a blackboard model and frame model. In the developed expert system, which is combined with a man-machined interface, it may be advantageous to use a production rule and forward inference. The inference was performed in two steps. The causes of weld flaws were firstly inferred from the welding condition, and then the final result was determined from the UT data. When the present expert system was applied to diagnosis of the welding flaw of a welded structure, the results obtained by the present system agreed with those obtained by the UT engineer up to about 90% of the time.

58851 *Chou, C.P.; Ho, B.; Sheu, J.T.*
**Material characterization by ultrasonics using unsupervised competitive learning**
Pattern Recognition Letters, Vol. 16, No. 7, pp. 769-777 (Jul. 1995)

A competitive learning network based on a new "conscience" learning algorithm is presented. A number of algorithms for competitive learning networks are compared to the proposed algorithm. The proposed algorithm is tested with different data sets and is shown to be efficient in obtaining near-optimal results. Clustering results produced by the network are checked by an internal index for cluster validity. This paper concludes with an application of the proposed network in acoustic imaging segmentation for material characterization.

58848 *Dunlop, I.; Mcnab, A.*
**Shape classification of flaw indications in three-dimensional ultrasonic images**
IEE Proceedings A – Science Measurement and Technology, Vol. 142, No. 4, pp. 307-312 (Jul. 1995)

The rapid evolution of computing hardware technology now allows sophisticated software technique to be employed which will aid the NDT data interpreter in the process of defect detection and classification. The paper describes an investigation into the area of three-dimensional ultrasonic image evaluation and, more specifically, the problem of characterising the shape of suspect flaw regions. A backpropagation neural network is used as the classifier for a series of four three- dimensional feature extraction methods which are individually assessed on two particular recognition problems.

58752 *Hill, E.v.K.; Knotts, G.L.*
**A neural network for predicting ultimate strengths of aluminum-lithium welds from acoustic emission amplitude data**
Nondestructive Characterization of Materials VI. Edited by R.E. Green, K.J. Kozaczek and C.O. Ruud. pp. 183-190. Plenum Press (1994) ISBN 0- 306-44816-5

AE flaw growth activity was monitored in a set of eleven aluminum-lithium weld specimens from the onset of tensile loading to failure. The amplitude data from the beginning of loading up to 25% of the expected ultimate strength for five of the specimens were used along with the actual measured ultimate strengths to train a backpropagation neural network to predict ultimate strengths. Architecturally, the fully interconnected network consisted of an input layer for the AE amplitude data, two hidden layers for mapping, and an output layer for ultimate strength. The trained network was then applied to the prediction of ultimate strengths in the remaining six specimens where the worst case prediction error was found to be 4.3%.

58751 *Soires, E.*
**An application of intelligent systems and acoustic emission in condition motoring of gear boxes**
Non-Destructive Testing – Australia, Vol. 32, No. 3, pp. 74-78 (May- Jun. 1995)

Research work discussed in this paper aimed at developing an acoustic emission technique capable of predicting maintenance requirements of gear