Abstracts

Review of Progress in Quantitative NDE

KI Convention Center – Green Bay, Wisconsin
July 27 – August 1, 2003

Organized by:

Center for Nondestructive Evaluation
Iowa State University

In cooperation with:

American Society for Nondestructive Testing

Ames Laboratory - U.S. Department of Energy

Federal Aviation Administration

National Aeronautics and Space Administration - LaRC

National Science Foundation
Industry/University Cooperative Research Centers

2003 Review of Progress in Quantitative NDE Program Summary

	8:00 am	9:00	10:00	11:00	12:00	1:00 pm	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00
Sunday July 27	KEY: Unless marked otherwise, meeting rooms are in Ballrooms A1, A2, A3, and A4 of the Convention Center					**Conference check-in and registration Lobby – KI Convention Center**						*Welcome Reception Regency Suites North Lobby 7-9 p.m.*		
Monday July 28		Plenary 1 • Laser UT: From the Laboratory to Industry – *A1,2,3*	Plenary 2 • NDE for Civil Engr Structures and Matls – *A1,2,3* • Structural Health Monitoring – Promises and Challenges *A1,2,3*		LUNCH	3. EC Arrays, Imaging, Inversion – *A1* 4. New Techniques and Systems – *A2* 5. NDE for Composite Materials – *A3* 6. Structural Health Monitoring I – *A4*								
Tuesday July 29	7. Guided Waves Modeling – *A1* 8. Joined Materials, Coatings, Interfaces – *A3* 9. NDE for Civil Materials and Structures – *A4* 10. Thermal Wave Imaging and Thermosonics – *A2*				LUNCH	11. Student Poster Competition – *Exhibit Hall*		11. Posters – UT Modeling, Materials Characterization, EC Probes – *Exhibit Hall*			*QNDE Conference Dinner National Railroad Museum Refreshments – 6 to 6:45 Dinner – 6:45 – 9 p.m.*			
Wednesday July 30	12. Laser UT – *A1* 13. Materials Char. – Elastic, Plastic, and Viscoelastic Properties – *A4* 14. Acoustic Emission – *A3* 16. UT Modeling, Scat. and Prop. – *A2*		15. Thermal Techniques – *A3*		LUNCH	17. Ferro. Matls. and Measurements – *A4* 19. New Techniques and Systems – *A3* 20. UT Trans., Matls., and Opt. Probes – *A1* 21. UT, EC, and MFL Mod. Benchmark Prob. – *A2*		18. Reliability and POD – *A4*					Future Directions in Sensors 8:00 p.m. *A1*	
Thursday July 31	22. Guided Waves, Models and Measurements – *A1* 23. Fatigue Cracks, Deformation, Buckling – *A3* 24. X-ray Modeling and Application – *A2* 25. In Process NDE – *A4*				LUNCH	26. Posters – EC, Mag. and Thermal NDE Model; Arrays; POD Imag.; X-rays; Tomography; Sig. Proc.; Residual Stress; New Sensors – *Exhibit Hall*		27. Future Applications of NDE Simulations – *A1*				5K FUN RUN		
Friday August 1	28. UT Arrays and Applications – *A1* 29. Materials Char. – Microstructure, Stress – *A4* 30. Eddy Currents – *A2* 31. Signal Processing – *A3*										*2004 QNDE Colorado School of Mines Golden, Colorado*			
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Tuesday, July 29, 2003

SESSION 11 – PART B: POSTERS
UT MODELING, MATERIALS CHARACTERIZATION, AND EDDY CURRENT PROBES
Exhibit Hall

3:30 PM

UT Modeling

Fast Imaging of 3-D Flaw Using Linearized Inverse Scattering Methods
---K. Nakahata and S. Hirose, Department of Mechanical and Environmental Informatics, Tokyo Institute of Technology, Tokyo, Japan; M. Kitahara, Department of Civil Engineering, Tohoku University, Sendai, Japan

Calculation of Guided Wave Scattering at a Defect in a Pipe
---T. Hayashi and K. Kawashima, Nagoya Institute of Technology, Nagoya, Japan; J. L. Rose, Department of Engineering Science and Mechanics, The Pennsylvania State University, University Park, PA

Three-Dimensional Boundary Element Modeling for Guided Waves Scattering from a Defect
---X. Zhao, Intelligent Automation, Inc., 7519 Standish Place, Suite 200, Rockville, MD 20855; J. L. Rose, Pennsylvania State University, Department of Engineering Science and Mechanics, University Park, PA 16802

Development of an Ultrasonic Testing Simulator Using the Mass-Spring Lattice Model
---E. Baek and H. Yim, Mechanical Engineering, Hongik University, Seoul, Korea

Transferring Distance-Amplitude Correction Curves Using Ultrasonic Modeling
---H.-J. Kim[1], L. W. Schmerr, Jr.[1,2], [1]Iowa State University, Center for NDE, 1915 Scholl Road, Ames, IA 50011, [2]Department of Aerospace Engineering; A. Sedov, Department of Mechanical Engineering, Lakehead University, Thunder Bay, Ontario, Canada, P7B 5E1

Modeling Ultrasonic Fields of a Transducer with Modular Multi-Gaussian Beam Model
---R. Huang and L. W. Schmerr, Jr., Iowa State University, Center for NDE, 1915 Scholl Road, and Department of Aerospace Engineering, Ames, IA 50011; A. Sedov, Department of Mechanical Engineering, Lakehead University, Thunder Bay, Ontario, Canada, P7B 5E1

Generic Ultrasonic 3D Ray Tracing Incorporating Beam Energy Models
---S. Dewangan[1], B. Rangan[2], A. Krishnamurthy[2], and G. Katragadda[1], [1]Industrial Imaging and Modeling Lab, GE India Technology Center, Bangalore, India; [2]Indian Institute of Technology, Madras, India

Materials Characterization

Thermoelectric Background Signature Due to the Presence of Material Property Gradients
---H. Carreon, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán 58000-888, Mexico; B. Lakshminarayan and P. B. Nagy, Department of Aerospace Engineering and Engineering Mechanics, University of Cincinnati, Cincinnati, OH 45221-0070

Impedance Spectroscopy of Liquid-Phase Sintered Silicon Carbide
---D. S. McLachlan[1], G. Sauti[1], A. Vorster[1], and M. Hermann[2], [1]School of Physics, University of the Witwatersrand, Johannesburg, South Africa; [2], Fraunhofer Institute for Ceramic and Sintered Materials Technologies, Dresden, Germany

Evaluation of the Formation of Rare Earth Complex in Silica Gels by Photoacoustic Spectroscopy
---Y.-T. Yang and S.-Y. Zhang, State Key Laboratory of Modern Acoustics, Institute of Acoustics, Nanjing University, Nanjing 210093, P.R. China

Generic Ultrasonic 3D Ray Tracing Incorporating Beam Energy Models

---S. Dewangan[1], B. Rangan[2], A. Krishnamurthy[2], and G. Katragadda[1], [1]Industrial Imaging and Modeling Lab, GE India Technology Center, Bangalore, India; [2]Indian Institute of Technology, Madras, India

---Ultrasonic data from inspections of complex structures such as aircraft engine components and weld regions of pipelines are difficult to interpret because of multiple interface reflections, mode conversions, and attenuation. Conventional ray tracing models are simplistic and do not account for beam energy distribution, mode conversions and attenuation. Finite element models are computationally intensive and not ideally suited for quick studies of energy defect interactions to aid data analysts. This paper presents an advanced 3D Ray Tracing model developed in Unigraphics incorporating beam energy distribution, attenuation, and mode conversion modeling. The model is ideal for generating quick animations to understand A-scans, B-Scans, and C-Scans from complex inspections. The model is generic and applicable to any arbitrary geometry. Results from calibration blocks demonstrate the model validity.

Thermoelectric Background Signature Due to the Presence of Material Property Gradients

---Hector Carreon, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán 58000-888, Mexico; Balachander Lakshminarayan and Peter B. Nagy, University of Cincinnati, Department of Aerospace Engineering and Engineering Mechanics, Cincinnati, OH 45221-0070

---The detectability of small and/or weak imperfections in noncontacting thermoelectric NDE is ultimately limited by the intrinsic anisotropy and inhomogeneity of the material to be inspected. This effort was aimed at the experimental investigation of the normal and tangential magnetic fields produced by thermoelectric currents due to the presence of weak inhomogeneity in a slender bar under axial heating and cooling when the material properties exhibit a linear spatial variation in the cross section of the specimen. Experimental results from a highly inhomogeneous artificial copper/brass sintered specimen were found to be in very good quantitative agreement with the predictions of a previously developed analytical model. Similar measurements on a weakly inhomogeneous Ti-6Al-4V titanium-alloy bar were also shown to be in very good qualitative agreement with the predictions of the same analytical model although the unexpectedly high magnitude of the observed signatures could not be verified by conventional contact measurements, therefore further efforts are needed to better understand the underlying physical phenomenon and clarifying the relationship between the strength of the signature and the very complex microstructural features of this popular high-strength alloy.