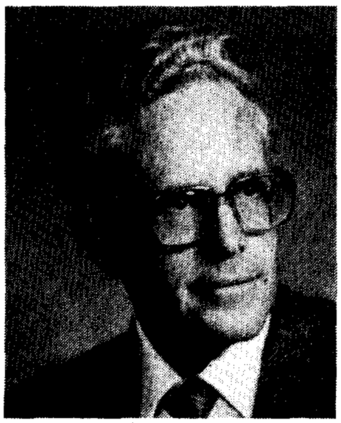
Fourth National Lecturer of the IEEE Sonics and Ultrasonics Group

THE Administrative Committee of the IEEE Group on Sonics and Ultrasonics announces that Dr. George A. Alers has been designated the fourth National Lecturer for the IEEE Sonics and Ultrasonics Group. As such Dr. Alers will be available to speak before SU Chapters, graduate and undergraduate student university seminars, and other appropriate local interest groups. Dr. Alers' topic for these talks will be Quantitative Nondestructive Evaluation—A Timely Confluence of Science, Engineering, and Economics.

The establishing of the National Lecturer Program and providing a stipend to cover travel expenses by the Sonics and Ultrasonics Group is an indication of the interest of the Administrative Committee in supporting the activities of sonics and ultrasonics groups. In addition to present SU Chapters, groups that are considering chapter formation, university groups, and other interested IEEE groups are encouraged to schedule the national lecturer, Dr. Alers, for their group. It is urged that those interested should contact the national lecturer at as early a date as practical so that he can organize his talks and schedules to best meet the group's needs. Please feel free to make copies of the full-page announcement of the following page to contact Dr. Alers.



GEORGE A. ALERS (M'76) received the B.A. degree in physics from Rice University, Houston, TX, and the Ph.D. degree in physics from Ohio State University, Columbus.

He has worked in industrial research laboratories all of his professional career, beginning with Westinghouse Research Laboratory where he was a metal physicist working on the basic mechanisms of fracture in high strength metals. Later, at the Scientific Laboratory of Ford Motor Company, he used ultrasonic waves to study the elastic and anelastic properties of materials as a function of temperature, pressure, and magnetic fields. It was here that he developed methods for measuring very small changes in the velocity of sound and used the technique to better understand the thermodynamics of superconductors to measure the third-order elastic constants and to detect the stiffening effect of magnetic field on the electron gas in metals. It was during his stay at the Science Center of Rockwell International that he applied ultrasonic wave concepts to nondestructive evaluation of such exotic materials as the thermal protection tiles for the Space Shuttle, fiber reinforced composites for aircraft and rubber windows for sonar systems. Currently, he is President of Magnasonics Inc., Albuquerque, NM, which specializes in research, development, and sales of electromagnetic acoustic transducers for the ultrasonic inspection of metals under high speed conditions and in remote locations.

Dr. Alers is a member of the American Institute of Mining, Metallurgical, and Petroleum Engineers, the American Physical Society, the Scientific Research Society of America, the Acoustical Society of America and the American Society for Nondestructive Testing. He was the 1976 recipient of the American Society Achievement Award for Nondestructive Testing. From 1978 to 1980 he was president of the IEEE Group on Sonics and Ultrasonics and vice president from 1976 to 1978. He was a judge for the International Science and Engineering Fair, Albuquerque, NM, in 1983. Currently he is on the editorial board of *Nondestructive Testing Communications* and also *Ultrasonics*.

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IEEE Sonics and Ultrasonics Group National Lecturer Program

Presents

Quantitative Nondestructive Evaluation—A Timely Confluence of Science, Engineering, an Economics

By

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WHERE ______________________________

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Abstract

Nondestructive testing (NDT) is a stepchild technology because it uses many disciplines and sometimes exhibits a rather tenuous connection with science. It is, however, important because U.S. industry spends nearly $120 billion a year on preventing fractures in materials and repairing the damage caused by such failures.* In recent times, the demand for high reliability in aircraft and space vehicles coupled with the drive to reduce fabrication costs have led to the widespread use of *fracture mechanics* to guide designers in deciding when to accept or reject a part that is not perfect. (It is very expensive to produce structures that have absolutely no defects or to throw away parts that can continue to survive their intended function.) In order to apply fracture mechanics, it is important to know the size, shape, and orientation of cracks or other inhomogeneities in a part so that a mathematical prediction of the failure load or the fatigue lifetime can be made. Thus, the modern practitioner of nondestructive testing becomes an engineer who applies quantitative analysis to evaluate the properties of mechanical structures and devices. Hence, the modern appellation *nondestructive evaluation* (NDE).

Among the tools for inspecting a part for hidden flaws, ultrasonics ranks near the top because it can penetrate the interior of heavy sections and the sound waves reflected by an inhomogeneity carry back information about the mechanical properties of the reflector. Furthermore, the acoustic waves can be easily con-

*Wall Street Journal, March 3, 1983.

verted into electrical signals that can be processed quickly in computers to give desired information in real time. Thus the geometrical properties of a crack demanded by fracture mechanics can now be automatically deduced at high speed without having to make an X-ray photograph and analyze the image with the eye of a human.

The talk to be presented will emphasize how ultrasonic nondestructive evaluation uses a combination of physics, mechanical and electrical engineering as well as computer science to make structures and machines more safe. Physics gets applied in the descriptions of how the ultrasonic waves propagate through inhomogeneous and anisotropic solids to become scattered and mode converted by a crack or sharp precipitate. Electrical engineering plays its role in designing the transducers to efficiently interconvert electrical signals and sound waves as well as to direct the sound beam in desired directions through the use of concepts found in optics and antenna theory. Computers are then used to process the signals so that the important information can be displayed or used to control the manufacturing process or to make an accept reject judgment. Examples of the products of this interdisciplinary approach will be drawn from the problems of inspecting buried gas pipelines, railroad rails, ceramic parts, welded joints, composite materials, and adhesive bonds.