

# New technique for nondestructive testing research

April 8 2005

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## *Technique uses vibration, heat detection to evaluate composite materials*

Ed Henneke, associate dean for research, and graduate studies in the College of Engineering at Virginia Tech, received the Award for Innovation in Nondestructive Testing Research at the American Society for Nondestructive Testing's 14th Annual Research Symposium in Albuquerque, N.M. This award was established to recognize highly distinguished individual achievements in research in nondestructive testing.

Henneke received this award for having proposed and developed a new technique for nondestructive evaluation of damage in advanced composite materials. He and his graduate students coined a word to name this new technique -- vibrothermography.

The technique is performed by applying low amplitude, high frequency mechanical vibrations (in the range of 15,000 – 30,000 cycles per second, just beyond normal human hearing) to composite materials and then using thermography to map temperature patterns that develop on the surface of the examined material. Thermography is the mapping of isothermal contour lines (points of equal temperature) on the surface of the material.

Henneke's research group found that hot spots developed on the surface of the material above regions of damage inside the material at specific frequencies. These hot spots became hot at mechanical frequencies that

could be related to the size of the damage area inside the material using a mathematical/physical model developed by the research group. The internal damage was not detectable by the human eye. Detection and analysis of such damage is important in the understanding of the ability of the material object to carry loads and not to fail catastrophically. Catastrophic failure can be responsible for economic loss or the loss of human lives.

The vibrothermography technique was developed at Virginia Tech in the Department of Engineering Science and Mechanics (ESM) in cooperation with Henneke's graduate students: Thomas S. Jones (MS, 1977), Samuel S. Russell (PhD, 1982), Shiang-Shin Lin (PhD, 1987) and Lazarus Tanek (MS, 1991). Henneke's students have since gone on to other successful ventures. Jones is presently working with Howmet Castings Corporation in nondestructive testing. Russell works for the NASA Huntsville Center applying nondestructive testing to problems of interest to NASA. Lin has returned to Taiwan and Tanek is presently a practicing civil engineer in Greece.

Throughout his career, Henneke has maintained a strong interest in his chosen research specialty of nondestructive testing. His studies have resulted in 11 books or chapters in books, 74 refereed technical papers in journals and periodicals, 91 technical reports and 157 technical lectures in both the US and Europe. His scholarly accomplishments in the field of vibrothermometry are recorded in the Encyclopedia of Materials Science and Engineering.

Henneke has been a member of the Virginia Tech faculty for 33 years, beginning as an assistant professor in 1971 and becoming a professor in 1978. He received his bachelor's and master's degrees in engineering science from the Johns Hopkins University in 1963 and 1966, respectively, as well as his Ph.D. in 1968.

Source: Virginia Tech

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