ADVANCED NDE RESEARCH IN ELECTROMAGNETIC, THERMAL, AND COHERENT OPTICS

by
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In the electromagnetic group, I investigated a new inspection technology called "Magneto-Optic/Eddy Current Imaging". The magneto-optic imager makes readily visible irregularities and inconsistencies (e.g., rivet holes, fatigue cracks, and subsurface corrosion) in airframe components. A highspeed frame grabber card, image processing solfware (IP Lab/PPG) and an external bias control allow for real-time computer image enhancement. A computer script consisting of background substraction, pixel averaging, histogram equalization, and linear filtering provided excellent real-time computer image enhancement of the anomalies.

Other research I observed in electromagnetics included (1) Disbond Detection Via Resonant Modal Analysis, (2) AC Magnetic Field Frequency Dependence of Magnetoacoustic Emission, and (3) Multi-View Magneto-Optic Imaging. Also while I was in electromagnetics, I had an opportunity to observe an experiment in radiography which involved the identification of various powders and metals via x-ray diffraction.

The thermal group is actively pursuing a number of avenues of research using thermal energy to quantitatively characterize various aerospace structures. Ongoing research I spent time in included: (1) Thermographic detection and characterization of corrosion in aircraft aluminum, (2) A multipurpose infrared imaging system for thermoelastic stress detection. (3) Thermal diffusivity imaging of stress induced damage in composites, and (4) Detection and measurement of ice formation on the Space Shuttle Main Fuel Tank.

The optics group is advancing the state of the art in optical NDE. Current activities of the remote sensing group I observed included: (1) Development of speckle interferometric and shearographic techniques to obtain quantitative strain field images of large surfaces (observed the analysis of subsurface stress on the space station nickel hydrogen batteries via shearography), and (2) Development of fiber optic sensors for the in-situ health monitoring of structures, with emphasis on aircraft and spacecraft structures (the concept of smart structures and skins).