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Anthony N. Mucciardi
Adaptronics, Inc.

R. K. Elsley
Rockwell International

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CHARACTERIZATION OF DEFECTS IN ADHESIVE BONDS
BY ADAPTIVE LEARNING NETWORKS

A. N. Mucciardi
Adaptronics, Inc.
Mclean, Virginia

R. K. Elsley
Rockwell International Science Center
Thousand Oaks, California 91360

ABSTRACT

Broadband ultrasonic pulses reflected from adhesively bonded structures have been used to train adaptive learning networks (ALN) to identify flawed regions of these structures. The goal is to identify four different types of flaws.

The steps involved in making a flaw decision (Fig. 1) include extracting a set of features from the measured waveforms, processing of these features by a set of ALN's and then using a decision scheme to combine the results of the various ALN's.

Four sample geometries containing built-in flaws were studied (Fig. 2). Normal incidence pulse echo measurements were made using a broadband 15 MHz transducer. Measurements were performed in a water bath with conventional transducers. The data was processed digitally (Fig. 3). Fig. 4 (right side) shows how the properties of the transducer can be removed from each waveform by "self-normalization."

RF waveforms from flawed specimens often show dramatic effects, such as the "quiet zone" in the disbanded sample shown in Fig. 4 (left side).

The current results (Fig 5) show good separation of the flawed specimens from unflawed and slightly flawed ones.

Fig. 1 Steps in the signal processing include feature extraction, ALN's and decision making.

Fig. 2 Four sample geometries containing built-in flaws were studied.
Fig. 3 Measurements were performed in a water bath with conventional transducers. The data was processed digitally.

Fig. 4 RF waveforms from flawed specimens often show dramatic effects; the properties of the transducer can be removed from each waveform by "self-normalization".
Fig. 5 Current results show good separation of the flawed specimens from unflawed and slightly flawed ones.