

# Use of artificial neural networks to detect damage in composite laminates

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Maintenance has remained an important issue in the aerospace structures and materials field. As technologies have improved, composites have begun to replace increasingly more structural components. However, these still have a long expected life for service use and damage can occur within that time. Ultrasonic sensors can be placed on or within composite laminates to scan for damage. Analysis of signals from these sensors is difficult for composites due to effects of material boundaries. A novel method of using artificial neural networks to interpret signals has been investigated for this research. A simple four sensor system was created for this study. Four sensors were placed 4.25 units apart. In a pitch-catch method, strain waves produced by one sensor (used as an actuator) passed through the material and were received by the other three sensors. The received waves are then analyzed by artificial neural networks and a damage position was predicted. This system has been trained to identify damage location within the square area for actuator signals ranging from 50 kHz to 100 kHz. The system of four sensors was demonstrated to predict the damage location with a confidence interval of 95%. The research presented is a novel method of interpreting ultrasonic signal analysis with artificial neural networks which could be adapted to future structural health monitoring systems.