Ultrasonic Inspectability of Composite  Parts with Tapered Thickness and High Ply Angles

Composite parts used in aerospace applications have inspection requirements to ensure parts will perform at expected levels. The out-of-plane wrinkle is one type of anomaly that needs to be detected, and through-transmission ultrasound is has demonstrated the ability to detect them. Wrinkles are detected as a loss of signal when the fiber deviates from being normal to the sound propagation direction, thus steering the sound away from the receiving transducer. Likewise, when the design of a component intentionally places fibers at a suboptimal angle, transmitted ultrasonic energy is lost, and the corresponding volume of material becomes uninspectable. Three examples of designs which introduce fibers at angles unfavorable for inspection include regions with tapered thickness, pad buildups around bolt holes and materials containing chopped fiber. These design strategies will be explored, considering the implications for their ultrasonic inspections.