

Detection of fastener loosening in simple lap joint based on ultrasonic wavefield imaging

ABSTRACT

Joints in aero-mechanical structures are critical elements that ensure the structural integrity but they are prone to damages. Inspection of such joints that have no prior baseline data is really challenging but it can be possibly done using the Ultrasonic Propagation Imager (UPI). The feasibility of applying UPI for detection of loosened fastener is investigated in this study. A simple lap joint specimen made by connecting two pieces of 2.5mm thick SAE304 stainless steel plates using five M6 screws and nuts has been used in this study. All fasteners are tightened to 10Nm but one of them is completely loosened to simulate the damage. The wavefield data is processed into ultrasonic wavefield propagation video and a series of spectral amplitude images. The spectral images showed noticeable amplitude difference at the loosened fastener, hence confirmed the feasibility of using UPI for structural joints inspection. A simple contrast maximization method is also introduced to improve the result.

Keyword: Fastener loosening; Simple lap joint; Ultrasonic wavefield imaging