

Title:

Delamination detection in thin-walled composite structures using acoustic pitch-catch technique with Fiber Bragg Grating Sensors

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Abstract:

Structural health monitoring (SHM) of a composite structure is essential in maintaining the integrity of the structure. Over the years, various studies have reported on the use of conventional electrical sensors in analysing acoustic wave propagation for delamination detection. However, electrical sensors are associated with drawbacks such as high signal attenuation, are prone to electromagnetic interference (EMI) and are not suitable for harsh environments. Therefore, this paper reported on the use of fiber Bragg grating (FBG) sensors for delamination detection. Two composite structures with delamination sizes of 10 cm × 2 cm and 10 cm × 6 cm were fabricated. Two FBGs were bonded before and after the delamination. In addition, three trials of impacts were induced at the centre of the structure. Multiple signal parameters were obtained and analysed, which were the time delay, amplitude difference and velocity difference. The experimental results revealed that the time delay, amplitude and velocity analysis varied for both the delamination sizes with an average percentage of 42.36%, 97.09% and 42.39%, respectively. Therefore, it was confirmed that the increase in delamination size resulted in a longer time delay, higher signal amplitude attenuation and slower wave propagation.

Keywords:

Fiber Bragg grating (FBG), thin-walled composite structures, acoustic waves, delamination, structural health monitoring (SHM)

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