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Fatigue delamination monitoring in composite structures by guided wave method.

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This paper presents an effective computational technique for fatigue delamination detection and monitoring by guided wave method. Unlike metallic alloys, fatigue damage can initiate in composite multilayered structures relatively early in their service life. Delamination is one of the most common type of damage in laminated fibre-reinforced composites due to their relatively weak interlaminar strengths. Thus, detection of fatigue delamination and monitoring of the damage growth is very important from reliability and safety point of view [1].
In this study the composite multilayered beam made of six epoxy resin prepreg layers reinforced with unidirectional carbon fiber with a single interlaminar delamination is considered (Fig. 1). The dynamic characteristic of multilayered composite beams and cylindrical panels was investigated by Muc and Stawiarski [3]. The guided wave method is one of the most efficient damage detection method and can be successfully applied for fatigue loading [2]. The comparison of the intact and defected beam allow to detect, localize and assess the size of the defect [4]. Different statistical measures can be applied to describe the difference between two signals [5]. In this study the Time-of-Flight (ToF) of the guided wave between an actuator and sensor was taken into account.

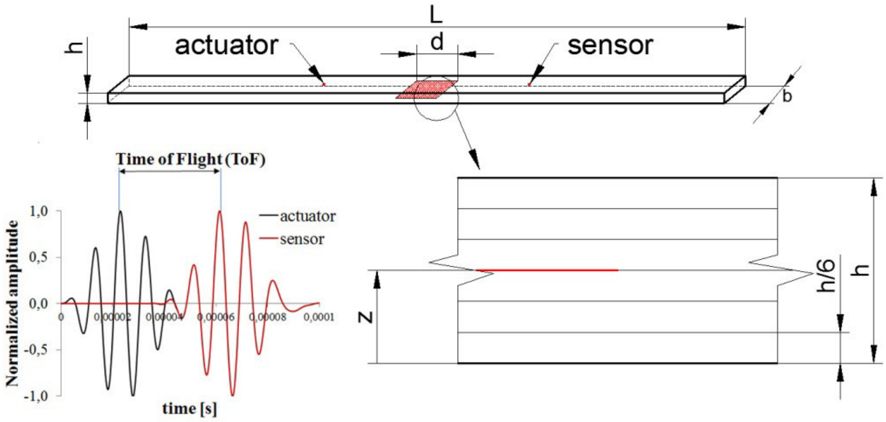

Fig. 1 Composite multilayered beam with a single interlaminar delamination

The numerical results (finite element method) for wave propagation in pitch-catch technique describe the relationship between ToF and delamination size (*d*) and position (*z*) (Fig. **2**). The characteristic of wave propagation in multilayered structures can be applied for damage detection, monitoring and prediction of the delamination growth.

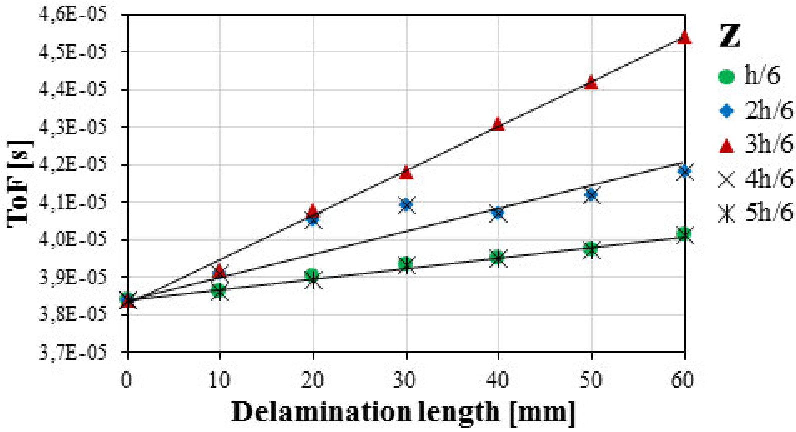

Fig. 2 Relationship between Time-of-Flight and delamination lenght for different position of the defect.

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