Damage quantification method in composite materials based on triangulation

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ABSTRACT

Thanks to their high strength to mass ratio, composite materials are now widespread in the aerospace industry. Nevertheless, this type of material is subject to internal damages like delamination. Structural Health Monitoring (SHM) is a process based on embedded sensors whose aim is to detect, locate, classify and quantify potential damages appearing in a structure in order to estimate its residual life. The most widely used technique to perform those steps in aeronautical structures made up of composite materials is based on the use of Lamb waves. In this paper, we will consider a damage quantification strategy based on a triangulation method. Such a method allows simultaneously both localization and size assessment of the delaminated area. This method, through the measure of the time-of-flight of Lamb waves, allows to compute for each path under study ellipses or hyperbolas that delimitate the damaged are. From this geometrical information, delamination position and area can be easily estimated. This method is validated on numerical simulation and on real experiments both carried out on CFRP plate samples equipped with piezoelectric sensor-actuator network with several configurations of position and damage size.

REFERENCES

[1] Sorrentino, Assunta, and Angelo De Fenza. "Improved Elliptical Triangulation Method for Damage Detection in Composite Material Structures." *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science* 231, no. 16 (August 1, 2017): 3011–23.