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# Local damage evaluation of a laminate composite plate using ultrasonic birefringence of shear wave

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## Abstract

This paper presents an ultrasonic non-destructive testing method to locally characterize composite material damage through the analysis of the anisotropy behavior variation induced by damage. The approach is based on shear wave contact measurements and analyses shear wave birefringence to estimate variation of the attenuation coefficient and shear moduli ratio between warp and weft directions. The method only requires a single piezo-electric contact sensor and thus, is easy to implement for practical applications. Moreover, unlike other methods, it does not require any reference measurement in a calibrated medium such as water to evaluate attenuation coefficient variation and shear moduli ratio. It is shown that the proposed method allows to locally qualify damage with good repeatability and robustness.

*Keywords:* Non-destructive testing, Ultrasonics, Damage induced anisotropy, Laminates, Shear wave birefringence

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## 1. Introduction

Composite materials are widely used in many sectors of activity such as aeronautics, automotive and naval industries, or civil engineering that require the use of both lightweight and mechanically efficient materials. In order to ensure integrity and safety of any composite structure, it is primordial to conduct mate-

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