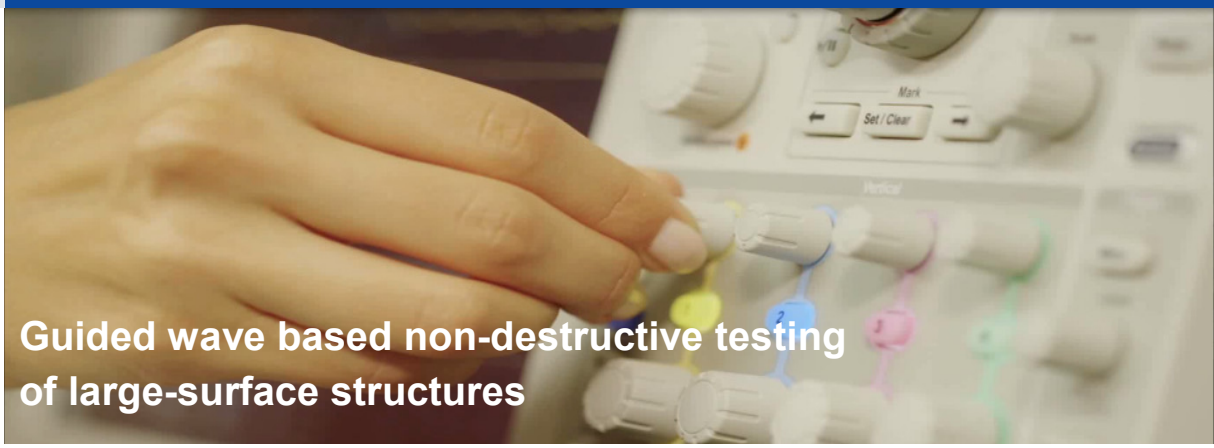
FASERINSTITUT FIBRE BREMEN

PROJECTS



Guided wave based non-destructive testing of large-surface structures

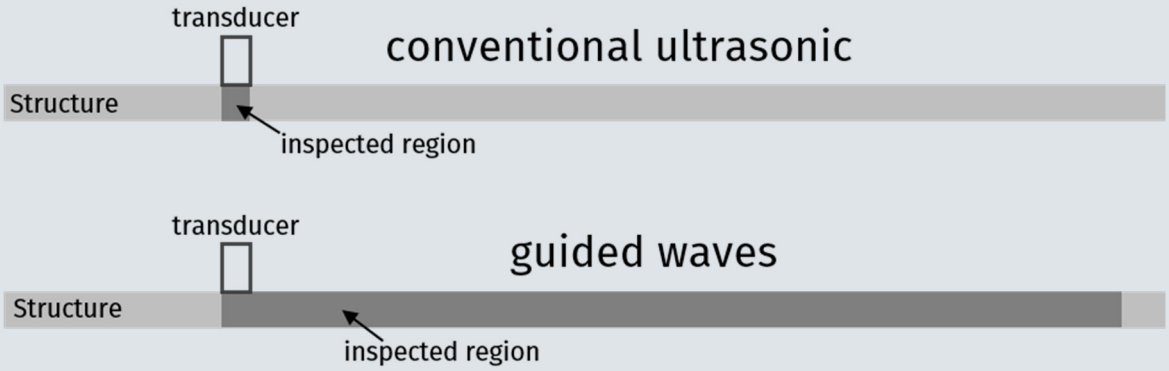
Abstract

In this project, we develop a non-destructive testing tool for structures made from fiber-reinforced polymers with large surfaces. In fact, this method bases on the analysis of guided waves propagating through the structure. At the end, the user is able to perform relevant and easy to use testing without special knowledge in material testing required.

Motivation

Concerning impacts (e.g. hail, stone chipping, bird strike or burst tyre), structures made from fibre-reinforced plies have their weakness at the interlaminar boundary layers. Thereby delaminations, separation of layers that is, may occur, which are often not visible from the outside. That is why such components often have to be costly tested—contradicting the economic and ecological benefit of lightweight materials.

Commonly, wave fields propagating through the sample are used for non-destructive testing (NDT). This is known from pointwise ultrasonic testing, where the test head scans a local restricted region. Hence, a scanning method, e.g. via phased arrays, is required to inspect a large surface. More time-efficient are techniques based on guided waves, with a wide-range propagation. In fact, this is the intrinsic motivation of the Deutsche Gesellschaft für zerstörungsfreie Prüftechnik (DGZfP) to certify guided waves methods for NDT. Within this project, we aim to make such methods practicable and easy to use to encourage further applications.



Two concepts: conventional ultrasonic vs. guided waves
The latter propagates along the structure, not through.

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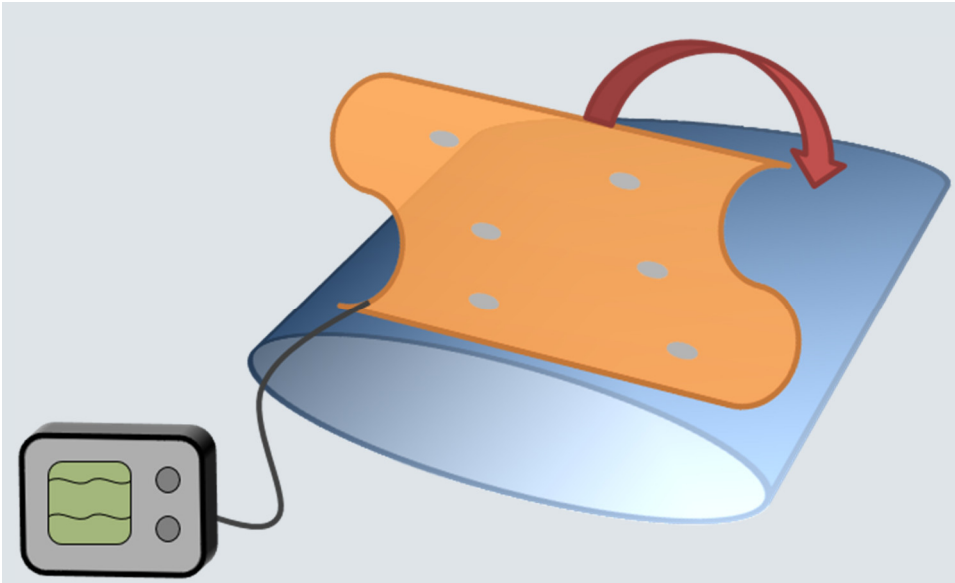
Ansatz

As necessity, the testing tool under development should mount prompt and simple. First, ensure an easy coupling of the transducers, used as transmitter and receiver as well. This requires a profound understanding of the temporary dry coupling's influence on the signal processing.

Therewith, determine a robust network of transducers, which allows to detect and to replace damaged or defect transducers. Using an appropriate transducers' distribution that optimally covers the structure, minimalistic data sets are generated and analysed automatically. Therefore, rapid and reliable processing tools for automated detection of anomalies in the structure are developed. Any existing repair spots should be taken into account. At the end, there is a testing tool for demonstration purpose. It is evaluated concerning its functionality as well as regarding its costs and sustainability.



Concept of a flexible carrier structure with integrated network of transducers for simple application at structures with large surfaces.

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Supporter

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Faserinstitut Bremen e. V.

The Faserinstitut Bremen e. V. is active in research and development tasks in areas of testing, development and processing of fibres, textile preforms and carbon fibre reinforced plastics. The department Measurement Systems and Monitoring is engaged in the development of measurement systems for assuring the product quality from fibre production via semi-finished fabrics to the final fibre reinforced product. Additionally, specifically developed methods assist in understanding the behaviour of the material.

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