

Contactless bonding assessment in laminated structures

Invention

An innovative air-coupled ultrasonic contactless method for non-destructive determination of defects in laminated structures has been developed and patented. Through a ingenious combination of ultrasonic transmitter and receiver probes with a specific data evaluation procedure disbonded regions can be individually detected and localized. Ultrasonic images reveal which lamellas are delaminated. The arrangement is mobile and can be used either in production lines or on-site on existing laminated structures (e.g. glulam roofing or bridges).

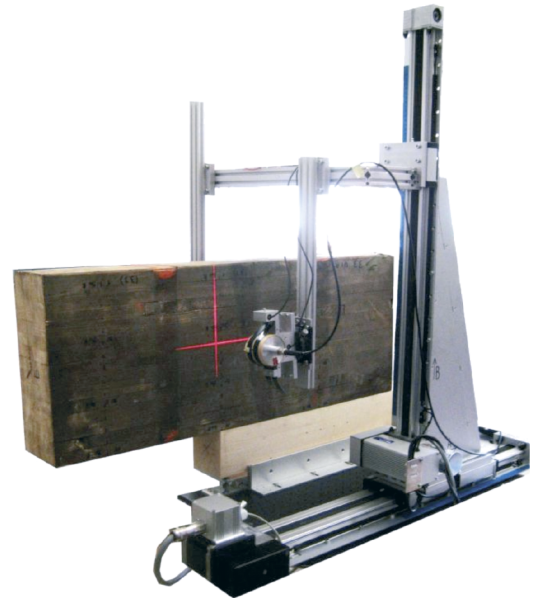
Background

Traditionally, laminated structures, e.g. glulam (glued laminated timber), are inspected visually and the depth of delaminations are measured with feeler gauges. Internal gaps that are not open to the outside cannot be found with this method. The use of liquid-coupled ultrasonic contact probes has the drawback of contamination and bad reproducibility. Conventional air-coupled ultrasonic transmission has been used for some time for production control of particle boards. Recently this technique has been refined for glulam, finally leading to the present patent.

Advantages

The invention is contactless and has a high reproducibility. Individual glue-line faults may be separately identified along the length, width and height of the beam. Due to the particular probe arrangement arbitrarily high stacks of laminates can be measured. The method can as well be applied in beam roofing applications in which access to some faces of the

laminates is constrained. A specific data evaluation procedure maximizes the detectability of defects by combining one or several measurements of the laminate (slightly different testing geometries, measurements in periodic intervals) with available or calibrated knowledge of material properties.



Applications

A reliable bonding quality assessment of glulam is necessary to reduce security hazards and maximize the life span of wooden constructions. This invention could be installed into a production line to detect delaminations faults immediately. At existing buildings a mobile installation can be used for quality control. Since single or multiple defects can be accurately located and sized within the laminates the invention provides also information where specific restoration actions are required. By performing the measurements in periodic intervals local changes in the bond quality can be detected, hence, helping to prevent a failure of the glulam beam.

Ownership

Empa, Swiss Federal Laboratories for Materials Testing and Research, Überlandstrasse 129, CH-8600 Dübendorf. Patent pending.

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Keywords

Air-coupled ultrasound; bonding quality; laminated structures; glulam; delamination detection

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