Augmented Reality meets NDT with Laser-Ultrasonics

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Abstract

Easy-to-handle non-destructive testing methods for components are getting more and more important to achieve “zero failure production”. Especially in the aerospace industry, the responsible quality managers have to follow a strict 200% testing-approach. This means, a full-faced checking of the part is performed by an automated NDT system as the first step of the procedure. Areas that show deviations from the reference dataset are marked as so-called „findings“. In a second step a qualified auditor needs to evaluate these findings on a PC-monitor as „ok“, „defect“ or „ignore“. Finally, these rated findings are required to be again validated by manual NDT measurements on the real component.

This rather unintuitive workflow requires a change of the perspective between the graphically illustrated dataset on a monitor and the real component, which is not only a further source of errors but also leads to focusing on the defective areas only. With the advancement in headsets, cameras, and tracking technology, augmented reality is gaining more and more traction. Augmented reality (AR) extends the physical world with digital assets, such as static or animated overlays. In this paper we will show the actual status of the project Aurea NDT dealing with a new way of showing Non-Destructive-Testing (NDT) results by augmented reality. By expanding the perception of the real environment (component under test) with additional information provided by the NDT measurements an intuitive way of working and interpreting the results is possible. For example, color-coded thickness values are displayed directly on the surface of the real component to give a very intuitive impression of the component’s shape or to show defects.

The result of at least two different NDT methods will be used to show the multimodal imaging approach, but here we will focus on the first method: Laser Ultrasonics. Laser Ultrasonics is a contactless NDT method which uses a high energy, short pulsed laser to generate acoustic waves by the locally concentrated heating of the surface (volume) of a sample. The heated surface (volume) expands very fast and therefore generates an acoustic wave with a very wide frequency range, typically for nano-second lasers in the range of 100kHz to around 50MHz. Detection of the acoustic waves is also done contactless by the use of a laser vibrometer, which is especially designed for rough or bad reflecting surfaces. As the system is therefore a single point analysis method, the whole area of interest on the sample is scanned. A typical result can be seen in figure 1. Figure 1 shows the C-scan at different depths, where artificial delaminations by the use of a one layer Teflon foil in different layers, are visible.
The used AR technology to image the NDT results on the sample is the Microsoft Hololens. The MS Hololens exhibits a very nice tracking ability and image quality, but the processing power and internal storage capability is very low, especially for NDT data. In the presentation we will show a way to overcome these limitations by the use of the Hololens in a remote way, by a data server which generates the reduced image data from the NDT results. Further the hardware and data structure will be shown.

The overall goal of the project AureaNDT is to research and develop a software framework, which is able to overlay NDT data from different sources (multimodal approach) on real objects by augmented reality technology.

Acknowledgements

The Project (“AuRea NDT - Augmented Reality meets NDT”) leading to these results has received funding from the state of Upper Austria (contract number 11747962).