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Developing confidence in automatic on-line quantification of surface defects.

Mitul Tailor, Punnu Phairatt, Jon Petzing, Michael Jackson, Rob Parkin

EPSRC Centre for Innovative Manufacturing in Intelligent Automation, Wolfson School of Mechanical & Manufacturing Engineering, Loughborough University, Loughborough, UK, M.Tailor@lboro.ac.uk

Automatic surface defect inspection within mass production of high-precision components is growing in demand and requires better measurement and automated analysis systems. The aerospace and automotive industries may reject manufactured parts that exhibit even minor defects, because a defect might result in an operational failure at a later stage. Defect quantification (depth, area and volume) is a key element in quality assurance in order to determine the pass or failure criterion of manufactured parts. Existing human visual analysis of surface defects is qualitative and subjective. 3D analysis should provide a robust and systematic quantitative approach for defect measurement. Various 3D measuring instruments generate point cloud data as an output, although they work on different principles. Instrument's native software processing of point cloud data is often subject to issues of repeatability and may be non-traceable causing significant concern with data confidence.

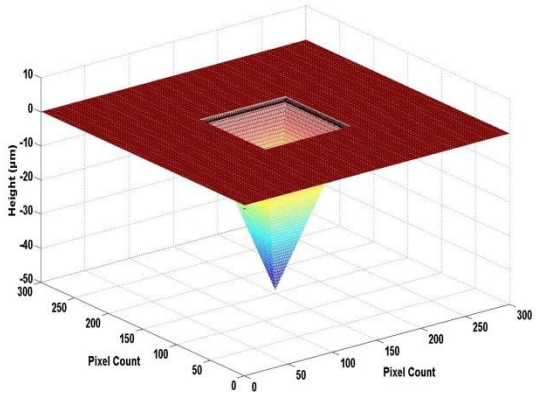

Figure 1: Isolated defect softguage

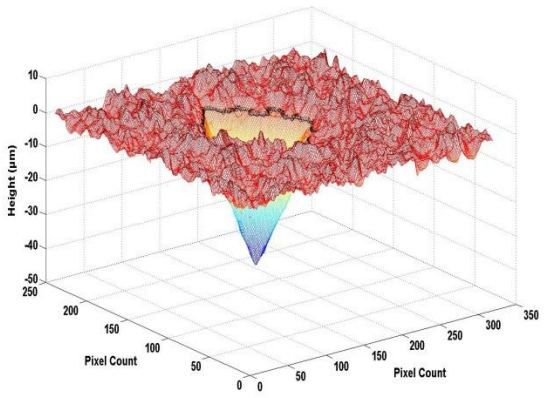

Figure 2: Isolated real defect

A novel algorithm to quantify defects automatically in 3D has already been reported. However, it is important to validate the algorithm in order to build-up the confidence in automatic defect analysis system and generated data. The work reported here charts the development of a novel 3D defect softguage with known size geometry (Figure 1). The defect softguage is characterised using the novel algorithm and results are validated. Moreover, a standard and traceable real defect is generated using Vickers equipment on a flat surface, and is measured using coherence scanning interferometer and quantified using the novel algorithm (Figure 2). The results show that automatic surface defect quantification is efficient, robust and more repeatable than current alternative approaches, and traceability to the metre can be achieved.

Significance Statement: The significance of this work is to demonstrate confidence in high speed, repeatable, traceable and automated defect quantification system that ensures inspection quality in small time frames.