Novel Remotely Deployed NDE for In-Service Industrial Inspection

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Aims: **To test the feasibility of utilising novel ultrasonic and visual signal processing developments in the safety critical industrial fields of the energy sector.**

Example Industrial Application: Caisson Inspection Platform

Caissons are large steel pipes found on offshore installations which are utilised to extract seawater from or to expel liquids into the sea. An inspection platform was designed by Inspectahire to inspect internals of caissons located on offshore oil rigs. The caissons exist in a region known as the splash zone where there are constant cycles of exposure to sea water and air. This leads to accelerated corrosion in the region. Other causes of reductions in structural integrity include but are not limited to: mechanical abrasion, longitudinal cracking, microbial induced corrosion, erosion-corrosion, fatigue cracking, weld corrosion and galvanic corrosion. These mechanisms will all lead to defects which lend themselves to higher levels of detection with different sensing technologies. Due to this the platform is designed to be versatile in mounting various sensing technologies.

Weld Inspection

Interpretation of the weld cap may be used for multiple applications such as live weld seam tracking for inspection robot positioning as well as use in automated robotic welding cells. As the results are to scale they may be also be used for weld cap sizing.

Inspection of weld caps is performed using multiple reconstructions from structured light images. This is the capture of 3D geometry from a calibrated pair consisting of a light source and a camera. The geometric relationship between the light source and the camera can be used to reconstruct 3D space from a 2D projection. This has been implemented for flat plate welds in a confined environment with the camera being driven in known steps by a robotic arm.

Future work will include implementing the system to determine the gap, orientation and alignment of two plates of metal prior to a welding run being completed.

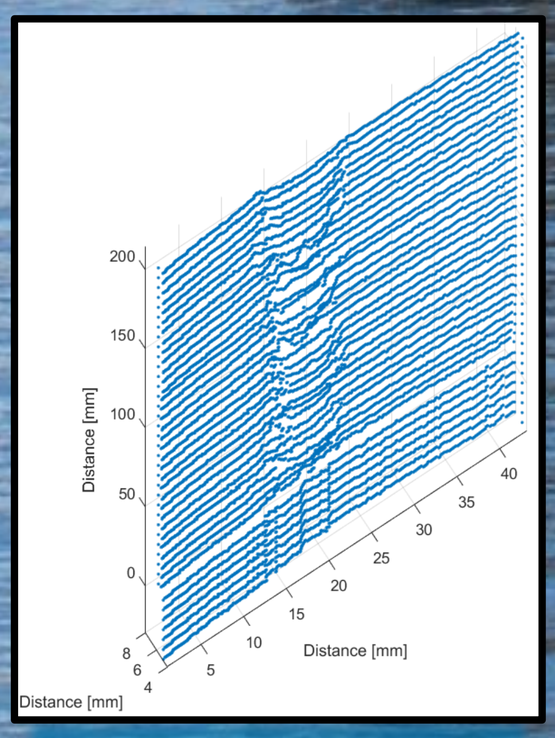
Thickness Mapping

Providing quantitative inspection information to the platform operator is vital in making a qualified decision on the remaining life expectancy of the asset in question.

Initial work has focussed on the deployment of automated ultrasonic thickness mapping. The resulting data consists of angular displacement, depth and thickness allowing for a three dimensional representation of the wall thickness across the caisson under inspection.

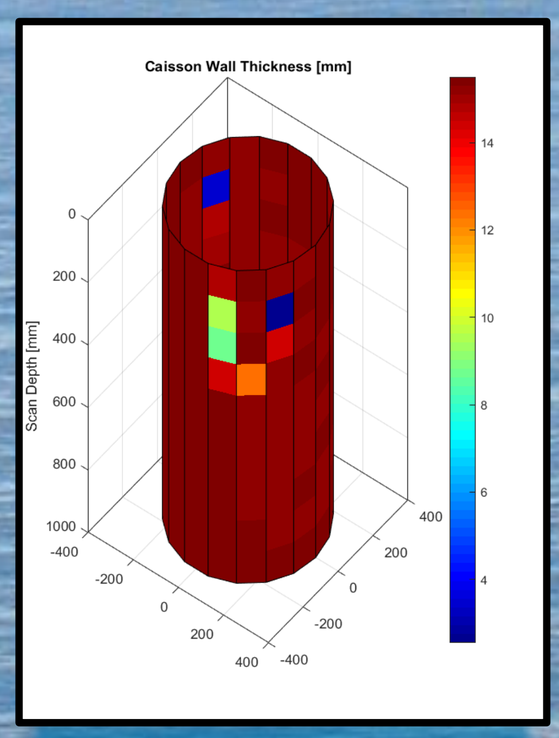
Future work will involve introducing a range of sensors to the platform, this will involve a comparison in the performance of the sensor and quality of data obtained. Furthermore, having multiple results using various methods allows data fusion to be performed detailing a more complete picture of the structural integrity of the caisson.

Weld Cap



3D Point Cloud of Weld Cap

Caisson Inspection Platform



UT Thickness Map

RCNDE UK Research Centre in NDE

CUE

inspectahire

Background Image: http://www.scottish-enterprise.presscentre.com