∫ound Mathematics

An Explainable AI for Characterising Damage of Industrial Structures

AutoII (IMAGE INSPECTOR) is an **application containing a unique explainable AI for interpreting images of damage**.

→ What can II do?

II can use images of damage to **characterise cracks** (fatigue, rough, stress-corrosion, cracks near welds) and defects in cement**.** It can create images collected with linear Phased Array of Ultrasonic Transducers (PAUTs).

It can also create and/or analyse corrosion maps and employ ASME or BS/EN standards to **assess fitness for service of corroded assets.**
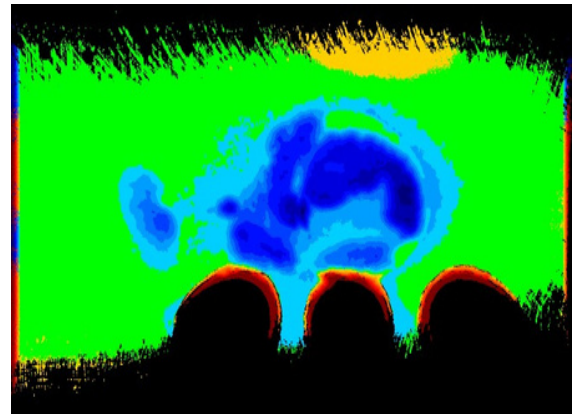

Thickness Map from 3D data by AutoII

→ How does it work?

The current crack characterisation module has been trained using **high quality lab data.** It is capable of assessing both cuboid and cylindrical structures, 2D and 3D.

The AI modules of are **custom** decision trees, based on 'if ... then' rules and fuzzy logic, producing **explainable results**.

End-use segments

- ✔ Nuclear plants
- ✔ Wind turbines
- ✔ Rails
- ✔ Bridges
- ✔ Ship building
- ✔ Automotive

→ About the product

II is available as a stand-alone app or online.
It was developed using data provided by CEA, Doosan Power Systems, TWI and Westinghouse, as part of a series of UK government-funded projects (total value over £1M).

> Automated SHM and NDT data processing is the key to increasing productivity and safety in the construction and manufacturing industries.

Product Features

Crack Characterisation

The crack charaterisation module combines signal processing, image processing and AI algorithms. It incorporates a novel flaw characterisation algorithm, a modified variant of TFM (Total Focusing Method), and takes into account undulations in inspection surface and back-wall.

When a component is tested in immersion, AutoII first uses the data to locate a set of points on each surface and then interpolates them using a polynomial of a degree identified automatically.

When a defect is imaged at different angles, comparing these images allows AutoII to assess the subjective probability of the characterisation being correct.

Corrosion Assessment

AutoII contains a module (FFS_ASSESS), which can stitch individual scans into a large scale image of the structure wall and decide which areas require assessment based on a minimum allowable thickness process.

In the event of an area failing to meet the requirements, an image of this area and details of the assessment are added to the report along with recommendations for rerating or repairing the vessel.

The remaining life calculation is made, based on the corrosion rate identified by a human inspector, to provide a recommendation for the next inspection data.
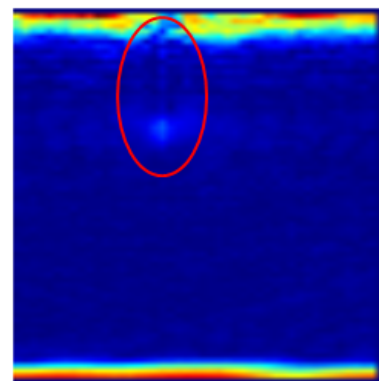
Potential developments

Both AutoII modules can be adapted to other materials (aluminium, iron, concrete), defects (voids) and geometries. They can be adapted to processing images created by other means, such as :

- eddy current,
- optical,
- radiology.

To affect these developments AutoII has to be trained on just a few but relevant datasets.

TFM image

GROUP - 1:

Defect depth = 1 mm
Defect extent = 7 mm
Defect orientation = 90 deg
Report quality = 40 %