



Industrial Member Report Summary – Key Findings for Industry

Literature Review on the Potential Use of Non Destructive Testing Techniques for Residual Stress Measurement

TWI Core Research Programme

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Industrial need

Most manufacturing processes result in residual stress. The level of residual stress can be high and could affect the structural integrity of the component. Without knowledge of the residual stress field, structural integrity assessments are often overly conservative as stress levels of yield magnitude are assumed. There are a wide range of non-destructive testing (NDT) techniques that are routinely used to inspect structures for flaws. It may be possible to adapt some of these techniques to measure residual stress instead. The report identifies and reviews the state-of-the-art of a number of candidate NDT techniques that could be suitable for residual stress measurement.

Key Findings

A number of techniques currently being used for non-destructive flaw detection have been identified for use in residual stress measurement as follows:

- Radiographic
- Ultrasonic
- Electromagnetic
- Thermography

Radiographic methods are already in use in industry, but are expensive and not fit portable or inexpensive. A significant amount of research has been conducted on other methods for residual stress measurement and potential has been identified. However, many of the methods are also sensitive to other factors such as surface roughness and microstructure. Additionally, the residual stress field is complex and whilst it may be possible to measure residual stress for a simple uniaxial stress field, there is work to be done to extract the individual stress components from the measurements made. Nevertheless, the ultrasonic, electromagnetic and thermographic non-destructive testing techniques discussed in the report are potentially portable and inexpensive to apply and therefore offer a possible future solution to the challenge of measuring residual stress effectively in-situ.

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