УДК 620.179.14

REVIEWING CHALLENGES IN THE APPLICATION OF EDDY CURRENT ARRAYS AND THEIR IMPACT ON NDT EFFICIENCY

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Eddy current arrays (ECAs) have gained significant popularity in the field of non-destructive testing (NDT) due to their ability to provide fast and accurate inspection results. However, several challenges associated with using ECAs in NDT need to be overcome in order to improve inspection performance. One of the primary challenges with ECAs is the impact of array size and geometry on inspection effectiveness. The size and shape of the ECA directly influence the sensitivity and resolution of the inspection process, making it challenging to optimize these parameters for specific inspection scenarios. Furthermore, the use of large ECAs can lead to increased noise levels and reduced inspection speed, negatively affecting the overall efficiency of the inspection process. Another significant challenge is the interpretation of inspection signals influenced by material properties [1]. The composition, structure, and thickness of the material being inspected can affect the eddy current response, making it difficult to accurately interpret the inspection results. Additionally, the presence of defects such as cracks or corrosion complicates signal interpretation, making it challenging to distinguish relevant signals from irrelevant ones.

Optimizing inspection parameters for different scenarios is a complex task. Various inspection scenarios require different inspection frequencies, coil configurations, excitation modes of probes, and signal processing techniques. Furthermore, complex geometries or surface irregularities further complicate the inspection process, necessitating the development of new inspection techniques and strategies [2]. To address these challenges, researchers are actively working on developing advanced signal processing techniques and novel ECA designs. Advanced signal processing algorithms are being developed to improve the signal-to-noise ratio, reduce false positives, and enhance defect detection capabilities. Additionally, the development of flexible and conformable ECA designs aims to improve inspection performance on complex geometries and irregular surfaces [3, 4].

The optimization of inspection parameters for different inspection scenarios in ECAs NDT poses a challenge due to the need to balance sensitivity and resolution. The selection of inspection parameters directly impacts the performance of ECAs. However, there is no universal solution as each inspection scenario presents unique challenges that require a customized approach. The expertise of NDT specialists is crucial in understanding this and adjusting equipment settings to achieve high-quality results.

To experiment with the ECA probe, a two-layer sample was diagnosed for non-adhesion between the layers, following the provided technological instructions. Different signal processing settings were used, resulting in varying quality outcomes.

This highlights the importance of selecting optimal inspection parameters and signal processing methods based on material properties, targeted defect types, and the available ECA equipment. The scanning process utilized an ECA probe consisting of multiple transducers, enabling efficient inspection of a larger material area. The probe design accommodated both manual and automatic testing.

Achieving optimal inspection parameters and signal processing for each specific scenario requires expertise in selecting and adjusting parameters to maximize system performance while minimizing false positives and false negatives.

While ECAs offer promising prospects for NDT, it is essential to acknowledge and overcome the challenges associated with their use to enhance inspection performance. Ongoing research and development in this field are expected to lead to improved ECA technology and enhanced inspection capabilities.

This presentation considers the significance of understanding signal formation and processing as integral components of the developed tuning methods and provides recommendations for effective utilization of ECA equipment. The presentation provides a comprehensive overview of the challenges associated with using ECAs for NDT and highlights the need for further research and development in this field. The identified problems include array size and geometry, material properties affecting signal interpretation, and the optimization of inspection parameters. The proposed solutions involve the development of new signal processing techniques and novel ECA designs. The presentation also emphasizes the use of computer modeling to optimize array design and presents experimental results showcasing the influence of display settings on result interpretation. The practical orientation of the article underscores the importance of considering scanning angle and real-world probe usage. Future work should focus on developing a testing methodology that addresses these limitations and enhances the effectiveness of ECAs in NDT applications.

References

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