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highlights

A novel framework is proposed for introducing Autoencoder algorithm into infrared thermography.
The capability of Autoencoder to improve defect visibility during inductive thermography is verified
Comparison study is implemented on experimental inspection data.
Quantitative evaluation is conducted by calculating defect contrast and signal to noise ratio.

Abstract:

Inductive thermography is one kind of infrared thermography (IRT) technique, which is effective in detection of front surface cracks in metal plates. However, rear surface cracks are usually missed due to their weak indications during inductive thermography. Here we propose a novel approach (AET: AE Thermography) to improve the visibility of rear surface cracks during inductive thermography by employing the Autoencoder (AE) algorithm, which is an important block to construct deep learning architectures. We construct an integrated framework for processing the raw inspection data of inductive thermography using the AE algorithm. Through this framework, underlying features of rear surface cracks are efficiently extracted and new clearer images are constructed. Experiments of inductive thermography were conducted on steel specimens to verify the efficacy of the proposed approach. We visually compare the raw thermograms, the empirical orthogonal functions (EOFs) of the prominent component thermography (PCT) technique and the results of AET. We further quantitatively evaluated AET by calculating crack contrast and signal-to-noise ratio (SNR). The results demonstrate that the proposed AET approach can remarkably improve the visibility of rear surface cracks and then improve the capability of inductive thermography in detecting rear surface cracks in metal plates.

Keywords: infrared thermography; inductive thermography; rear surface cracks; Autoencoder

1. introduction

Cracks are serious defects for metal parts and may cause eventual failure of metal structures. Non-destructive testing (NDT) techniques have been widely employed to detect cracks in metal