Shearography NDT System for Cylindrical Surface Inspection

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Introduction. Shearography has been widely used in non-destructive testing(1), however traditional system based on shearography is low efficiency, because it’s needed move and readjusted when inspecting big and complexed structure. In order to enhance the inspection efficiency of shearography system, an automated non-destructive inspection system has been developed for bonding quality inspection of a cylindrical surface based on shearography.

Automated inspection system. The structure of interest in this investigation is a solid cylinder with a heat proof coating adhesively bonded around the exterior. A schematic diagram of the structure is shown in Fig. 1(a).

![Fig. 1 Scheme of the test system](image)

The inspection system consists of a shearography device with a pair of heating lamps, a mechanical transmission system, and a control unit (Fig. 1(b)). The mechanical transmission system includes a translation mechanism for the shearography measurement unit and thermal radiation device which can moved along the axial direction of the cylindrical structure, and a rotation mechanism that rotates the cylindrical structure without damaging it. The control unit includes a computer and a control box.

Automatic recognition of defects. Faster R-CNN model has been introduced in defect detections for laser shearography(2). A schematic diagram describing the process for automatic recognition of defects based on Faster R-CNN model is shown in Fig. 2. The training data set which includes typical fringe patterns of defects have been established to train the model parameters. The results show that the trained Faster R-CNN model can accurately identify defects from the typical fringe patterns.

![Fig. 2 Process for automatic recognition of defects based on Faster R-CNN model](image)

Conclusion. An automated nondestructive inspection system based on shearography with thermal excitation has been developed that enables automatic inspection of a thermal insulation layer bonded onto a solid cylindrical structure. The inspection routine is automatically scheduled by simply inputting the geometries of the sample including length and diameter. An image recognition technology based on Faster R-CNN model has been developed to evaluate the inspection results, which provides the possibility for performing online non-destructive inspection of defects by shear speckle interferometry. In comparison to the traditional means using manual inspection, this system provides an automated inspection system which improves efficiency and accuracy.

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References.