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HIGHLIGHTS

- Infrared Thermography deals with the acquisition and analysis of thermal data.
- Phase shifting method determines the phase map from a set of thermographic images.
- Contrast to noise ratio is used to distinguish the two regions of interest.
- Four-step phase shifting provides the excellent result at optimum frequency 0.01 Hz.

ABSTRACT

This paper presents an experimental arrangement for detection of artificial subsurface defects in a stainless steel sample by means of thermal wave imaging with lock-in thermography and consequently, the impact of excitation frequency on defect detectability. The experimental analysis was performed at several excitation frequencies to observe the sample beginning from 0.18 Hz all the way down to 0.01 Hz. The phase contrast between the defective and sound regions illustrates the qualitative and quantitative investigation of defects. The two, three, four and five-step phase shifting methods are investigated to obtain the information on defects. A contrast to noise ratio analysis was applied to each phase shifting method allowing the choice of the most appropriate one. Phase contrast with four-step phase shifting at an optimum frequency of 0.01 Hz provides excellent results. The inquiry with the effect of defect size and depth on phase contrast shows that phase contrast decreases with increase in defect depth and increases with the increase in defect size.

Keywords: Subsurface defect, Thermal wave imaging, Phase shifting, Contrast to noise ratio