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Examination of imaging of thinning area in thin metal plates by guided wave propagation using scanning elastic wave source technique by airborne ultrasound phased array

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Abstract We are studying non-destructive testing by scanning elastic wave source technique using an airborne ultrasound phased array (AUPA). [1]

In this report, we verified the detection of defects in thin metal plates by scanning elastic wave source technique using the AUPA constructed by two types of ultrasound emitters with different diameters (frequency 40 kHz, diameter 8 mm and 10 mm). [2]

1. Introduction

We are studying non-contact non-destructive testing by the scanning elastic wave source technique using Airborne Ultrasound Phased Array (AUPA). [1]

In this report, we experimentally verified the detection of defects in thin metal plates by the scanning elastic wave source thecnique using the AUPA with different element pitch of ultrasound emitters. [2]

2. Experimental equipments and method

Figure 1 shows a schematic view of the experimental devices. Devices consist of two AUPAs (drive frequency 40kHz, applied voltage $24V_{p\text{-}p}$) shown in Fig. 2, a function generator, an amplifier, a data logger, an AE sensor, a preamplifier, and a PC that controls peripheral devices.

The experiment was performed according to the following procedure. First, a high-intensity focused ultrasound wave is irradiated to each position in the measurement area by scanning the sample plate at intervals of 2 mm, and a guided wave is excited on the sample plate. The guided wave of vibration information is acquired along with coordinate information of sound irradiation by an AE sensor on the sample surface. After the wave source scanning in the measurement area is completed, the guided wave propagation image is acquired by synchronously reproducing the time waveform corresponding to each excitation point.

3. Experimental results

According to the result by AUPA with the ultrasound emitter element pitch of 10 mm, the amplitude of the wavefront is not uniform, and defects cannot be sufficiently visually recognized. On the other hand, in the result by AUPA with the element pitch of 8 mm, the scattering of guided waves at the defect position could be clearly visualized by suppressing GLs.

4. Conclusion

The effect of GLs on the guided wave propagation by the scanning elastic wave source technique was investigated using AUPA with different ultrasound emitter element pitch. As a result, when a guided wave was generated by AUPA with an emitter with a diameter of 8 mm(element pitch:8 mm), the guided wave scattering at the defect position could be clearly visualized by suppressing GLs.

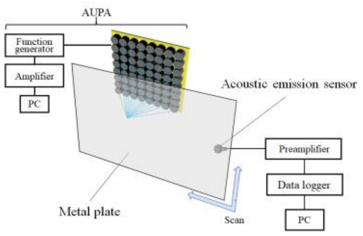
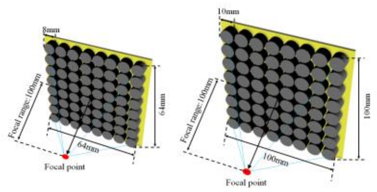


Fig. 1 Measurement devices.



(a). AUPA8 (Pitch 8mm)　(b). AUPA10 (Pitch 10mm)

Fig. 2 Schematic view of AUPA.

References

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