

Phased Array with Surface Acoustic Wave (SAW PA) for Screening and Sizing of Surface Defects

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Nondestructive inspection of whole structures is important for the safety and reliability. For the inspection of internal defects, ultrasonic testing (UT) with bulk waves has been widely used, whereas such UT cannot inspect surface due to a dead zone. To this end, we proposed a phased array with surface acoustic wave (SAW PA) [1,2] for rapidly inspecting surface defects with a high sensitivity. However, the performance has yet to be fully elucidated because it was not optimized in terms of the wedge and imaging region. The objective of this study is to improve SAW PA and to demonstrate the wide-range and detailed imaging capabilities for screening and sizing, respectively. The schematic of SAW PA is illustrated in Fig. 1. An array transducer is set on a wedge with a critical angle of Rayleigh wave. Following a delay law, SAW is focused on multiple focal points on the surface, providing an image over the scan area. Note that SAW PA has a capability of a real-time imaging. In this study, the wedge for SAW generation was improved. In the previous study [1], the wedge was made of acrylic resin that is inexpensive and has good workability. It is however relatively attenuative, so that the incident wave was significantly attenuated during the propagation in the wedge. Therefore, it was changed to polystyrene that is less attenuative. The polystyrene has smaller critical angle than acrylic resin, thus also shortening the propagation distance in the wedge. This is useful for both screening and sizing. To show the wide-range imaging capability, a hole specimen (A6063) was imaged with varying the propagation distance of Rayleigh wave. As a result, a sufficient signal-to-noise ratio was obtained even in a far distance of 400 mm (Fig. 2). Subsequently, it was applied to the crack specimen, where the imaging area was set beneath the wedge to attain high resolution and sensitivity, although the region outside the wedge was selected for screening and in Ref. [1]. As a result, the crack was clearly imaged with a high resolution. These results show that the improved SAW PA is useful for both screening and sizing.

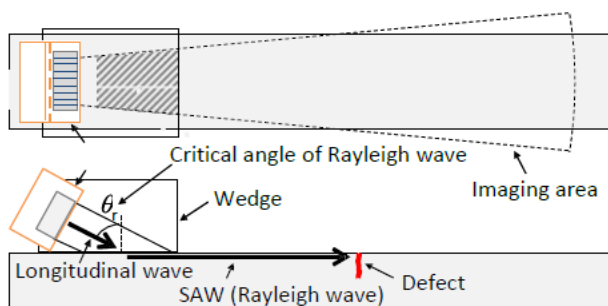


Figure 1. Schematics of SAW PA.

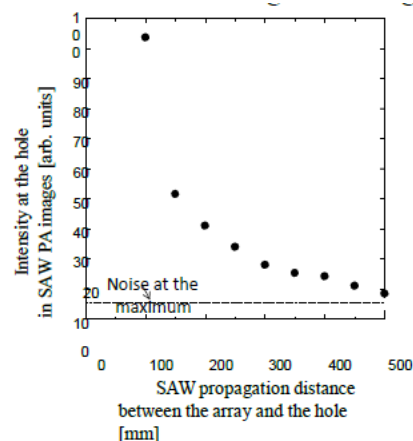


Figure 2. Experiment for screening.

References:

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