Novel Methods to Measure Surface Wave Velocity by Using Laser-generated Tone-burst Surface Wave

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Ultrasonic wave velocity is a characteristic of material, which is considered as a significant factor of nondestructive testing (NDT) techniques. Generally, bulk wave velocity is measured by Time-of-Flight (TOF) of pulse echo from back wall reflection; however, pulse-echo method cannot be applied to surface acoustic wave in a case that an edge does not exist in a close range. Even when we use through-transmission method, it is quite cumbersome to measure the accurate distance between transmitter and receiver; this problem is more critical when using contact angle transducers.

This study proposes two new signal processing methods to measure laser-generated surface wave velocity. The laser was irradiated on the line-arrayed slit to generate tone-burst surface wave, and the propagated surface wave was received by a contact transducer. The first signal processing method uses the auto-correlation to calculate the time Δt that the wave takes to pass through the interval of slit, and then velocity is calculated using the equation: $C = \frac{d}{\Delta t}$, where d is the interval of the slit. The second method uses FFT to find out the main frequency of the wave, and then the velocity is calculated from the equation: $C = f \cdot \lambda$ where f is main frequency of surface wave, λ is the wavelength of surface wave, where λ is identical to the interval of slit d. Experimental results show that the two signal processing methods provide almost same performance and the velocity of the laser-generated surface wave can be measured in a precise manner by using the proposed signal processing methods.
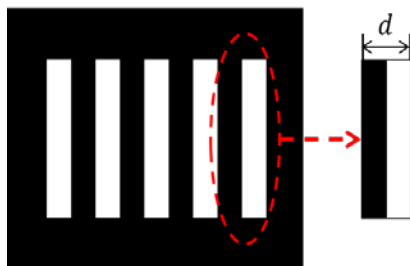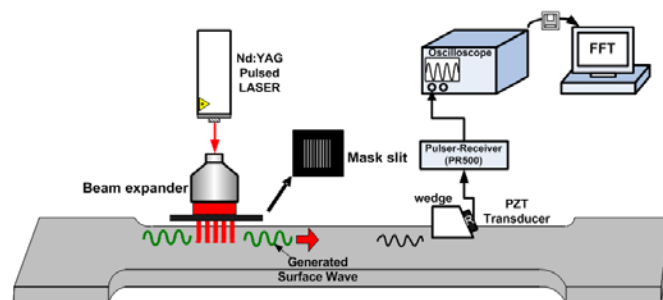
Acknowledgement:

Figure 1. Line arrayed slit

Figure 2. Experimental setup