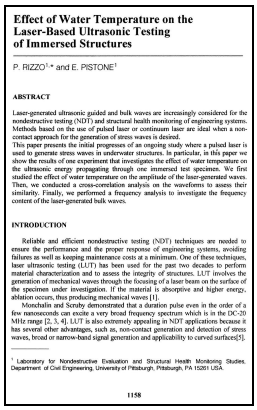

Effect of Water Temperature on the Laser-Based Ultrasonic Testing of Immersed Structures

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ABSTRACT

Laser-generated ultrasonic guided and bulk waves are increasingly considered for the nondestructive testing (NDT) and structural health monitoring of engineering systems. Methods based on the use of pulsed laser or continuum laser are ideal when a non-contact approach for the generation of stress waves is desired.
This paper presents the initial progresses of an ongoing study where a pulsed laser is used to generate stress waves in underwater structures. In particular, in this paper we show the results of one experiment that investigates the effect of water temperature on the ultrasonic energy propagating through one immersed test specimen. We first studied the effect of water temperature on the amplitude of the laser-generated waves. Then, we conducted a cross-correlation analysis on the waveforms to assess their similarity. Finally, we performed a frequency analysis to investigate the frequency content of the laser-generated bulk waves.

INTRODUCTION

Reliable and efficient nondestructive testing (NDT) techniques are needed to ensure the performance and the proper response of engineering systems, avoiding failures as well as keeping maintenance costs at a minimum. One of these techniques, laser ultrasonic testing (LUT) has been used for the past two decades to perform material characterization and to assess the integrity of structures. LUT involves the generation of mechanical waves through the focusing of a laser beam on the surface of the specimen under investigation. If the material is absorptive and higher energy, ablation occurs, thus producing mechanical waves [1].
Monchalin and Scruby demonstrated that a duration pulse even in the order of a few nanoseconds can excite a very broad frequency spectrum which is in the DC-20 MHz range [2, 3, 4]. LUT is also extremely appealing in NDT applications because it has several other advantages, such as, non-contact generation and detection of stress waves, broad or narrow-band signal generation and applicability to curved surfaces[5].

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1158

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Ключевые слова:

Содержание.