The Influence of Additively Manufactured Specimen Thickness on Laser-Induced Ultrasonic Signals

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Selective laser melting (SLM) technology, employed in metal additive manufacturing, is widely utilised to fabricate components with precise dimensions and excellent mechanical properties by melting powder layer by layer. Laser ultrasonic testing is anticipated to be an efficient method for in-line monitoring in the additive manufacturing (AM) process. The conversion of specimens from thin to thick during the SLM manufacturing process has an impact on the ultrasonic signals. This paper focuses on the influence of AM specimen thickness changes on ultrasonic signals. In the finite element analysis, the incremental specimen thickness was maintained at 0.2 mm, which was the initial value. As the specimen thickness increased sequentially, ultrasonic signals were obtained from different specimens. The results demonstrate that Lamb waves are generated when the specimen is thin, and the dispersive characteristics weaken as the thickness increases. The dispersive phenomenon diminishes significantly once the specimen thickness exceeds 1 mm. By employing the f-k method, calculated dispersion curves for various specimen thicknesses were obtained. After fitting the derived dispersion curve, a mapping relationship is established with respect to the specimen thickness. Consequently, the fitting coefficient of the dispersion curve can therefore be utilized to characterize the thickness of the additive manufactured thin specimen.