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### 激光与光电子技术应用

## 金属圆管管壁厚度对瑞利波影响的研究

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摘要: 为了探究管道中瑞利波信号的产生、传播规律, 基于热弹激发机制, 建立了激光线源在偏心圆管侧面激发超声波的有限元模型, 研究了在不同激发源厚度下及不同曲率半径下铝质圆管中瑞利波的产生、传播规律。结果表明, 均匀薄管中, 管壁厚度在一定程度上决定了所产生的超声信号的成分, 并且在一定范围内, 超声信号也会随着管壁厚度的变化而变化; 在非均匀管道中, 激发源处的管壁厚度对超声信号的产生有很大影响, 能在一定程度上决定超声信号的成分。这一结果对激光超声在管状材料的无损检测中的进一步应用是有帮助的。

关键词: 激光技术 瑞利波 有限元方法 管状材料

## Effect of thickness of metal hollow cylinders on laser thermo-elastic generated Rayleigh wave

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Abstract: To study the propagation of Rayleigh waves in a hollow cylinder, a finite element algorithm is put forward to simulate laser inducing Rayleigh waves in a hollow cylinder based on the thermoelastic mechanism. The Rayleigh waves induced by line laser source in hollow cylinders with different source-thickness and different radius were simulated and typical results were presented. Simulation results show that in the uniform thin hollow cylinder, the composition of ultrasonic waves is partly determined by the thickness of the hollow cylinder, and in a certain range, the ultrasonic waves are changing when the thickness of the hollow cylinder is changing; in the non-uniform hollow cylinder, the thickness of the source-thickness has a great influence on the generation of ultrasonic waves, and to some extent, it can determine

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the components of the waves. This work will provide a useful guidance for the further application of laser ultrasonic in the cylinder nondestructive testing field.

Keywords: laser technique Rayleigh waves finite element method cylindric metal

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