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论文

激光热弹激励流-固泄漏Lamb波的有限元模拟

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摘要 根据变分原理，得到热弹体运动方程和热传导方程相对应的有限元方程. 通过数值积分方法求解有限元方程，得到脉冲激光线源在水/铝、空气/铝这两种流-固界面上热弹激励的泄漏Lamb波瞬态波形. 计算结果表明，泄漏Lamb波不但存在于液-固界面，而且存在于气-固界面；和Lamb波相反，泄漏Lamb波的S_0模态是反对称的，而A_0 模态是对称的；但由于这两种流-固界面的性质差异导致泄漏Lamb波的波形和幅度不同.

关键词 流-固界面 泄漏Lamb波 激光超声 有限元模拟

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Finite element simulation of leaky lamb wave at fluid-solid interfaces excited thermoelastically by pulsed laser

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Abstract

Based on the variation principle, the corresponding finite element equations for the thermoelstic and heat conduction equations are obtained. The finite element equations for the fluid-solid interface waves propagated along the water-aluminum, air-aluminum interfaces are solved by using the numerical method of integration, and then the transient waveforms excited thermoelastically by a pulsed laser line source are obtained. The results show that the leaky Lamb wave exists at the liquid-solid interface and also exists at air-solid interface; in reverse to the Lamb wave, the S_0 mode of leaky Lamb wave is antisymmetric, and the A_0 is symmetric; due to the difference of the two kinds fluid-solid interfaces, the waveforms and amplitudes of the two leaky Lamb waves are different.

Key words fluid-solid interface leaky Lamb wave laser ultrasonics finite element simulation

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