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无穷大周期加筋微穿孔板结构振动响应及吸声特性

Dynamic response and acoustic absorption characteristics of an infinite micro-perforated plate periodica stiffened by ribs

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英文关键词:dynamic response micro-perforated plate space harmonic acoustic absorption ribs

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中文摘要:

研究在平面声波斜入射情况下,无穷大双周期加筋的微穿孔薄板结构的振动响应及吸声性能。首先在马大猷和Takahashi微穿孔板声学理论基础上,建立了微穿孔加筋薄板结构的半解析模型;然后应用傅里叶变换及空间波数分析方法,将周期加筋微穿孔薄板的振动位移及辐射声压表示为频域内波数的分量迭加形式;最后通过对波数分量进行求解,并利用傅变换得到双周期加筋的微穿孔薄板的振动响应及吸声系数表达式。计算结果表明,薄板的弯曲振动在水中对吸声的影响较大,空气中仅对轻质穿孔板的低频吸声效果有一定影响;同时孔率对周期加筋薄板吸声系数的影响明显,通过改变穿孔率和加筋周期等可有效地提高水中微穿孔薄板结构的吸声性能。

英文摘要:

The vibration response and acoustic absorption characteristics of an infinite micro-perforated plate periodically stiffened with ribs in two orthogona directions,which is excited by a plane wave at an arbitrary incident angle,are analyzed in this paper.Based on fundamental acoustic formula of the micro-perforated plate of Maa Da You and Takahashi,a semi-analytical model of the vibration response of the studied structure is developed.Using the Fourier trans method and the space harmonic analysis method,the vibration displacement and acoustic radiation pressure of the micro-perforated plate are expressed as infi sets of space harmonic amplitudes.After numerically solving these amplitudes,the vibration response and acoustic absorption coefficient of the micro-perfora plate in the physical space are finally derived by employing the Fourier inverse transform method.Numerical results indicate that the flexural vibration of plate has a significant effect on the acoustic absorption in the water and has a certain influence for the light micro-perforated plate at the low frequency in the air.It is also found that the absorption coefficient of the micro-perforated plate is strongly depended on its micro holes; meanwhile,the absorption performance can be effectively improved by adjusting the dimensions of stiffened ribs,especially in the water.

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