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多排柱腔列对平面P波和SH波的隔离

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ISOLATIONS OF PLANE P AND SH WAVES BY BARRIERS COMPOSED OF SEVERAL ROWS OF CYLINDRICAL CAVITIES

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摘要 运用复变函数的保角映射方法和波函数展开法, 利用P波和SH波耦合散射的特性, 根据土体在柱腔壁处完全自由(即径向应力和切向应力为零)的边界条件, 得到了多排柱腔列构成的非连续屏障对平面P波和SH波隔离的二维平面问题的理论解, 通过绘制屏障后归一化位移(同一点处由入射和散射波产生的总位移与入射波单独产生的位移之比)的等值线图, 分析了多排柱腔对平面P波和SH波的隔离效果, 并与单排刚性桩作了对比, 结果表明: (1) P波和SH波的隔离效果都随着柱腔排数的增多而明显提高; (2) 在半径、间距和屏障整体宽度相同的条件下, 要超过单排刚性桩屏障的隔离效果, 对于P波, 需两排柱腔, 而对于SH波, 则需三排柱腔。这为多排柱腔屏障的隔振设计提供了理论依据和参考。

关键词: 多排柱腔列 非连续屏障 平面P波和SH波 隔离效果 隔振设计

Abstract: The conformal mapping method of complex functions and expansion methods of wave functions were adopted, the coupling scattering properties of P wave and SH wave were considered, the boundaries of the cavities without radial normal stresses and shear stresses were assumed to be free, and then the theoretical solutions for the two-dimensional multiple scattering problems of incident plane P and SH waves were obtained by the discontinuous barriers composed of several rows of cylindrical cavities. By studying the normalized displacements which are the ratios of the displacements caused by both the incident and scattered waves to those only by the incident waves, the isolation effects of the barriers composed of several rows of cylindrical cavities were analyzed, which were also compared with those of a row of rigid piles, and some important conclusions were drawn out. They are: (1) the isolation effects increase with the rows of cylindrical cavities, and (2) in order to get better isolation effects than that of a row of rigid piles with the same radius, the space distance and total barrier width to cylindrical cavities, two rows of cylindrical cavities are needed for incident P waves, and three rows for SH waves. And these conclusions provide some theoretical basis and references for the vibration isolation design of several rows of cylindrical cavities.

Key words: several rows of cylindrical cavities discontinuous barrier plane P and SH wave isolation effects vibration isolation design

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