# 圆管表面斜裂纹应力强度因子和临界裂纹长度仿真分析 Simulation of Stress Intensity Factors and Critical Crack Length of Surface Oblique Crack on Round Tube

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关键词： 表面斜裂纹 应力强度因子 临界裂纹长度 应变能密度 复变函数

摘 要： 针对圆管表面斜裂纹，建立基于弹性断裂理论和复变函数理论的计算模型。研究圆管表面斜裂纹发生扩展时临界状态所对应的应力强度因子和裂纹临界尺寸在各种相关因素影响下的变化规律。以I、II型复合裂纹为例，采用应变能密度理论对其进行了分析。对开裂角、裂纹所处角度及裂纹的几何尺寸等因素的影响进行仿真计算。得到裂纹所处角度对复合型裂纹两个应力强度因子影响的曲线，并对其影响的程度进行了比较。另外，对裂纹所处角度和开裂角对临界裂纹长度的影响进行了仿真分析。结果表明：随着裂纹所处角度的增加，两个应力强度因子（ KⅠ、KⅡ）的最大和最小值是相同的，但趋势相反。并且对于Ⅰ型裂纹，在 β=0和 β=2π的地方，其应力强度因子为零。 Calculation models were established based on the elastic fracture theory and complex function theory for the surface oblique crack on round tube. Change in stress intensity factors and critical crack length were investigated when surface oblique crack on round tube developing propagation considering different influencing factors. Take crack type Ⅰ and type Ⅱ for example, by using the strain energy density theory, a complete analysis was performed. The influence of crack initiation angle, crack angle and size on the stress intensity factors was calculated. The influence curves of crack angle on two stress intensity factors of the mixed-mode crack were obtained. Then, the influence extent was compared. Moreover, the complete analysis on the influence which cracked initiation angle, crack angle on the critical crack length was performed. The results showed that with the increase of the crack angle, the maximal and minimal values of the two stress intensity factors ( KⅠ, KⅡ ) were same, however, the tendency was opposite. Moreover, to type Ⅰ crack , the stress intensity factors on the position of β=0 and β=2π were equal to zero.

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