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柔性接头有效摆心漂移特性

Characteristics of effective pivot point excursion for flexible joint

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中文关键词: [摆心漂移](#) [几何球心](#) [柔性接头](#) [推力矢量控制](#) [固体火箭发动机](#)英文关键词: [pivot point excursion](#) [geometric pivot point](#) [flexible joint](#) [thrust vector control](#) [solid rocket motor](#)

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中文摘要:

设计了带缠裹式防热套的柔性接头, 弹性件和防热套材料均采用硅橡胶。研究了柔性接头有效摆心和几何球心的关系, 采用2阶四项式Mooney-Rivlin模型模拟弹性件的本构关系, 利用ANSYS软件分别仿真计算柔性接头在压强为0, 9MPa下不同摆角条件的有效摆心和几何球心漂移, 得到了两者的漂移包络线, 把仿真的有效摆心漂移结果与试验测量值进行比较, 并利用间隙碰撞试验验证了几何球心漂移仿真结果的准确性, 在此基础上研究了有效摆心漂移的原因。结果表明: 摆心包络线的仿真结果与试验结果吻合较好, 有效摆心和几何球心是两个不同的概念, 柔性接头的有效摆心漂移在半径为2.5mm, 高为1.4mm的圆柱包络面内, 而几何球心的漂移在半径为0.013mm, 高为0.6mm的圆柱包络面内, 有效摆心漂移是由接头各层增强件和弹性件的变形不同引起的。

英文摘要:

A miniature flexible joint using silicone rubber elastomer and wrapped insulating boot was designed. The relation between effective and geometric pivot points was studied. The quadrinomial second order Mooney-Rivlin invariant model was used to describe the constitutive relationship of the elastomer. The excursions of effective and geometric pivot points of flexible joint at different vector angles under 0MPa and 9MPa vessel pressure were calculated respectively using ANSYS. Both effective and geometric pivot point cylinders were obtained. The simulation and experiment results of effective pivot point were compared. The accuracy of the geometric pivot point excursion was verified by the experiment of clearance crash. In addition, the reason of the effective pivot point excursion was also studied. Results show that the simulated effective pivot point cylinder has a good agreement with the experiment. The effective and geometric pivot points are of different concepts. The effective pivot point excursion is limited to a radius of 2.5mm, 1.4mm high cylindrical envelope while the geometric pivot point excursion is limited to a radius of 0.013mm, 0.6mm high cylindrical envelope. The effective pivot point excursion is caused by different strains of each reinforcement and elastomer.

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