吴志荣,胡绪腾,宋迎东.多轴随机载荷下的疲劳寿命估算方法[J].航空动力学报,2014,29(6):1403~1409

多轴随机载荷下的疲劳寿命估算方法

Estimation method for fatigue life under multi-axial random loading

投稿时间：2013-03-18

DOI：10.13224/j.cnki.jasp.2014.06.021

中文关键词: 寿命预测 多轴疲劳 随机载荷 临界平面 循环计数

英文关键词:life prediction multi-axial fatigue random loading critical plan cycle counting

基金项目:基础科研项目

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中文摘要:

提出了一种多轴随机载荷下的疲劳寿命预测方法.通过雨流计数法对各平面上的剪应变进行循环计数，以统计出的剪应变循环作为多轴疲劳损伤的主要控制参数，将各剪应变循环历程内对应的最大正应力和正应变变程作为多轴疲劳损伤的第二控制参数.根据多轴疲劳寿命模型计算出各平面上的损伤，以最大损伤平面作为多轴随机疲劳的临界平面，通过该临界平面上的损伤计算出多轴随机载荷下的疲劳寿命.采用SNCM630钢，304不锈钢和S45C钢3种金属材料的多轴随机疲劳试验数据对提出的寿命预测方法进行评估和验证.结果表明：疲劳寿命预测结果大都分布在试验结果的2倍分散带之内.

英文摘要:

An estimation method for fatigue life under multi-axial random loading was proposed.Firstly the rain-flow counting method was used to identify shear strain cycles on each plane.The shear strain cycles were taken as a main control parameter of multi-axial fatigue damage.Then the maximum normal stress and normal strain range within each shear strain cycle were calculated as the second damage control parameter.The damage of each plane was calculated by multi-axial fatigue life model and the critical plane was identified as the plane with the maximum damage.The fatigue life was determined using the damage associated with the plane.The method for fatigue life under multi-axial random loading was evaluated and validated by the multi-axial random fatigue test datum of SNCM630 steel,304 stainless steel and S45C steel.The multi-axial random fatigue life prediction results of these materials are almost within a factor of two scatter band of the test results.

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