

论文

基于塑性应变的变幅应力疲劳损伤评估方法

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摘要:

中碳车轴用钢的旋转弯曲疲劳实验结果表明,在其疲劳极限以上,应力-寿命数据满足三参数曲线关系,因此,其变幅应力作用下的疲劳损伤不能使用基于应力的线性累积损伤法则评估.本文结合中碳车轴用钢恒幅和高/低两级多次变幅应力的旋转弯曲疲劳实验数据,基于恒幅应力作用下S--N曲线倾斜部分曲线,提出了可用于材料在变幅旋转弯曲作用下的疲劳损伤评估的方法.该方法考虑材料在疲劳过程中发生的循环硬化或循环软化,通过塑性的循环本构关系将应力--寿命数据转换为符合线性关系的塑性应变--寿命数据,然后基于塑性应变满足线性累积损伤的条件,进行基于塑性应变的变幅应力疲劳损伤评估.

关键词: 变幅应力 循环本构 塑性应变 疲劳损伤

EVALUATION METHOD OF FATIGUE DAMAGE UNDER VARIABLE AMPLITUDE STRESS BASED ON PLASTIC STRAIN

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Abstract:

The fatigue damage under the stress amplitude below fatigue limit is evaluated based on the modified Miner's rule usually. The medium carbon railway axle steel shows obvious cyclic softening or hardening behavior during fatigue process. The result of rotary bending fatigue test on medium railway axle steel shows that the stress-life data above the fatigue limit tally with three parameter mode. Therefore the fatigue damage of this steel under variable amplitude stress can't be evaluated based on the stress linear cumulate damage rule. According to the rotary bending fatigue data obtained from the rotary bending fatigue test under constant and high-low two levels periodic variable amplitude stress, a method oevaluating variable rotary bending fatigue damage of mterial whose icline part of the S-N curve under constant amplitude stress loading is curve, was presented. Considering the cyclic hardening or cyclic softening durig the ftigue process, the stress-life data were transformed to the inear plastic strain-life data according to the cyclic constitutive reitionship of this material. Afterward the fatigue damage under variable amplitude stress was evaluated by plastic strain obeying the strain linear cumulate damage rule.

Keywords: variable amplitude stre cycle constitutive plastic strin fatigue damage

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