

材料工程

厚壁圆筒自增强压力的优化分析

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摘要:

采用考虑材料应变强化效应和包辛格效应的双线性材料模型,建立了厚壁圆筒自增强理论模型。基于工作时的等效应力及周向应力,提出了最佳自增强压力的评定方法并给出了理论求解过程。采用有限元软件对自增强厚壁圆筒涉及三个加载过程进行模拟分析,模拟结果与理论计算结果相吻合。由模拟结果得到了厚壁圆筒工作时的最大等效应力和最大周向应力与自增强压力的关系曲线,并采用直接加权组合法进行优化,得到了最佳自增强压力。研究结果为厚壁圆筒最佳自增强压力的求解提供了新思路,具有一定的工程意义。

关键词:

厚壁圆筒 自增强压力 双线性模型 加权组合法

Optimization Analysis of Autofrettage Pressure for Thick Walled Cylinders

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Abstract:

A bilinear kinematic hardening autofrettage model was established and the stress formulae of three loading procedures were derived considering the strain-hardening and Bauschinger effect of material. Based on the hoop and equivalent working stresses, the best autofrettage pressure of thick walled cylinder was assessed and deduced. The relevant three procedures were simulated and the effect of autofrettage pressure on the maximum hoop and equivalent working stresses was established and the relation curves were given using finite element software.

Multi-objective function was converted into single objective function using weighted array model and the best autofrettage pressure was obtained when the total objective function reached minimum. The research results herein provide new methods for acquiring the best autofrettage pressure and are valuable to practical project applications.

Keywords: thick walled cylinder; autofrettage pressure; bilinear model; weighted array

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