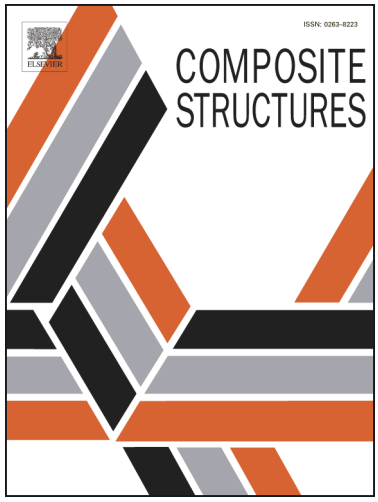

Fatigue Reliability Design of Composite Leaf Springs Based on Ply Scheme Optimization

Chen Qian, Wenku Shi, Zhiyong Chen, Shixiang Yang, Qianqian Song

PII: S0263-8223(16)32105-5
DOI: http://dx.doi.org/10.1016/j.compstruct.2017.02.035
Reference: COST 8256

To appear in: *Composite Structures*

Received Date: 9 October 2016
Revised Date: 14 January 2017
Accepted Date: 7 February 2017

Please cite this article as: Qian, C., Shi, W., Chen, Z., Yang, S., Song, Q., Fatigue Reliability Design of Composite Leaf Springs Based on Ply Scheme Optimization, *Composite Structures* (2017), doi: http://dx.doi.org/10.1016/j.compstruct.2017.02.035

Fatigue Reliability Design of Composite Leaf Springs Based on Ply Scheme Optimization

Chen Qian, Wenku Shi, Zhiyong Chen*, Shixiang Yang, Qianqian Song

State Key Laboratory of Automotive Simulation and Control, Jilin University, Changchun 130022, China.

Correspondence should be addressed to Zhiyong Chen: chen_zyjlu@126.com

Abstract

The study of composite leaf springs has been popular in automotive light weighting. Particularly, the research on the fatigue reliability of composite leaf springs is crucial. This paper proposed the fatigue law inference of the parabolic composite leaf spring, which was validated by fatigue bench tests. On the bases of the ply scheme design method and the sandwich unit concept, the non-continuous layer section and the stacking order were presented. The stacking sequence was optimized using Genetic Algorithm. The production of composite leaf spring samples, on which the fatigue bench test was conducted, was based on the optimized ply scheme. Results indicate that the fatigue life of composite leaf springs can be improved by using the proposed ply scheme design method.

Key words: composite leaf spring; fatigue reliability; stacking sequence Optimization; Genetic Algorithm

1.Introduction

Energy shortage and environmental crisis have intensified in the recent years. Safety, energy conservation, and environmental friendliness have become the basic requirements of modern vehicles**. Therefore, the advantages of steel replacement by plastic in composite leaf springs can contribute to the production of lightweight vehicles greatly. In addition, composite leaf springs improve energy efficiency and riding comfort significantly. Thus, the positive design of composite leaf springs has been a popular topic in the past years [1–3].** Composite leaf spring optimization [4–5], fatigue life prediction [6], and joint reliability [7] have been studied by several scholars abroad. However, the optimization of composite leaf spring design is still underdeveloped. Composite leaf springs serve as the elastic elements and guiding mechanism of the suspension. Hence, the fatigue reliability of composite leaf springs plays a significant role in the