Fayoum University
Faculty of Engineering
Industrial Engineering Department

Characterization of Composite Leaf Spring under Different Loading Conditions

By

Hwida Mohamed Arafat Hussein

A thesis submitted in partial fulfillment
Of
The requirements for the degree of
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In
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ABSTRACT

Composite materials have been used in many applications such as aerospace, marine, railways, and construction industries. Composite materials have enhanced properties over metals such as large weigh reduction, excellent mechanical and chemical properties. Therefore, it gains special position when developing vehicles.

Suspension system is one of the vital components during the vehicles design. Leaf springs are considered as one of the most important components of the suspension system. It is as an elastic body, whose function is to distort when loaded and to recover its original shape when the load is removed by means of spring deflection. This deflection generates potential energy in the leaf spring which is then relieved slowly. The ability to store more amount of strain energy ensures a comfortable suspension system. Leaf springs are used in suspension system to safeguard the vehicle and the occupants.

This work deals with the replacement of steel leaf spring with composite leaf spring. Strain energy for both steel and composite leaf spring is obtained. In addition, this work aims to investigate flexural test of composite material under three point bending as it is an important aspect for leaf springs. Composite leaf spring has better durability, higher stiffness and load carrying capability which can improve the flexural strength compared to that made from steel. In order to improve bending properties, aluminum oxide (Al_2O_3) and silicon carbide (SiC) nano-particles fillers are added to the composite with different weight ratios at 0, 1, 3, and 5 wt.% in both monolithic and hybrid forms. Experimental and finite element analysis on glass fiber reinforced polyester with/without fillers are done. The finite element analysis was done via ANSYS software. The results show that the fillers improve the bending properties up to limiting values and then decrease. Where, the maximum value of flexural strength for Al_2O_3 nano fillers occurs at 3 wt.% with a value of 482.17 MPa and for SiC and hybrid of Al_2O_3 & SiC occur at 1 wt.% with values of 420.79 and 434.85 MPa, respectively.

The summary not more than 500 words