ABSTRACT

Thesis Title: **Effect of Shot Peening Parameters on Fatigue Design**
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Leaf springs are subjected to varying stresses and vibrations due to road conditions. Influence of high contact pressures and temperatures follow fretting fatigue between two mating leaf surfaces. Few crack based correlation for fatigue crack growth are available in fatigue design of components. Stress based improvement model for fatigue design shot peened leaf springs, is discussed in the present thesis.

The fatigue life of 65Si7 spring steel leaf springs has been determined experimentally at various shot peening conditions and optimum shot peening intensity is found. Full-scale leaf springs laboratory testing and specimens testing were carried out to show the extent of improvement in fatigue life due to shot peening. Structural damping is found to be an important surface characteristic of shot peened surface for reducing fretting fatigue. Effects of shot peening conditions and damping factor for minimizing fretting fatigue failures, are discussed. A correlation has been established between damping factor and compressive residual stress field.

A lot of research has been done to improve the fatigue strength of materials by creating compressive residual stress field in their surface layers through the shot peening. While many fatigue strength data is available from test specimens, and the engineer can use these data as a starting point. The best data are obtained by full-scale testing of actual components under realistic conditions. However, there is no mathematical model currently available in the literature to predict fatigue life of components at various shot peening conditions from specimens. In

this research paper, the axial fatigue strength of spring steel specimen is evaluated experimentally as a function of shot peening in the conditions used for full-scale leaf springs testing in industries. Optimum shot peening conditions for specimen is found and S/N curves of the specimens are correlated with leaf spring curve. A computer program based on mathematical model has been developed which predicts fatigue life of leaf springs for a given stress at varying shot peening conditions. Predictions from this model are compared with experimental data.

The Phenomenon of surface roughness is important while considering contact between metallic bodies. The effect of shot flow rate on surface roughness was identified. The effect of surface roughness on fatigue and fretting fatigue behaviour of EN45A springs steel leaf springs was studied using electro – hydraulic testing system. Full-scale leaf springs laboratory testing was carried out to show the extent of improvement in fatigue life due to shot peening. Double shot peening was done o leaf springs and its effect on surface roughness, compressive residual stress field and fretting-fatigue was noted. A correlation was found between surface roughness and fatigue life of shot peened leaf springs.

The axial fatigue strength of springs steel leaf springs has been evaluated experimentally as a function of shot peening parameters for the application in the automotive vehicles. Fatigue design of shot peened leaf springs has been illustrated with an example for improvement in fatigue life, higher fatigue strength and reduction in weight. A stress based model has been developed for improvement in fatigue design of leaf springs used in automotive vehicle for economy and reliability. Certain factors have been identified when shot peening doesn’t increase fatigue life of leaf springs in industries. The model developed in the present work is found to be useful in situation when shot peening does not improve fatigue life of in industries.