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Formulation of weighted goal programming using the data analysis approach for optimising vehicle acoustics levels

Abstract

Two factors for customers to consider when purchasing a vehicle are the vehicle acoustical comfort and the vibration in the vehicle cabin, both of which contribute to a comfortable driving environment. The amount of discomfort is included by frequency, magnitude, direction, and the period during which the noise is experienced and also where the vibration is experienced in the cabin. The main sources of vibration that have been identified previously are the vibration transmitted from engine and the vibration transmitted from the interaction of the tires with the road surface. In this study, we investigate the effect of the vibration caused by the tire interaction with the road surface by estimating the amount of noise produced due to this phenomenon. The methodology focuses on the trends which occur in the noise exposure and on the vibration exposure that has been generated throughout the engine operating rpm range in both stationary and non-stationary conditions. The vibration dose value (VDV)f was used to assess the amount of vibration exposure that is transmitted to the driver's body in the cabin. Through the study, we have proved that the vibration caused by the tire-road surface contact is a major contributor to the cabin's interior noise. Based on the results, a goal programming method was developed to optimise the noise level in the cabin by considering the vibration as an input in the model. Finally, a multi-objective goal programming was developed successfully which could be used to optimize the noise level in the cabin by looking at the value of the VDV required at particular engine speeds (rpm).

Keywords

Vehicle acoustics; Vibrations (mechanical); Acoustic noise;