

Abstract

Nowadays, the environmental conditions inside a vehicle represent a goal of research and development for most manufacturers.

Given the increase of the analysis between the human being and the different environmental stimulus which influence comfort inside a vehicle, comes the need to develop new methods which allow the modulation of the individual and combined response of the human response to environmental discomfort stimulus.

The main goal of the developed work concerns the evaluation and modulation of the human being's response regarding different environmental discomfort stimuli, as well as their integration at a global discomfort sensation level inside a bus.

Two evaluation methodologies were developed: one about the noise discomfort inside the bus; and the other related to the global discomfort, which also allows an individual analysis of the stimuli.

Regarding the first methodology, psychoacoustic tests were conducted, giving origin to a modulation of the acoustic discomfort level through a rate, designated *ADLB* (*Acoustic Discomfort Level in Buses*), where the following variables are taken into account: the sound pressure level A-weighting, the articulation index, loudness and sharpness.

The second methodology concerns the human response modulation regarding the global discomfort level, according to the different environmental discomfort stimuli considered: thermal environment, vibration, noise, air quality and lighting. The metric parameters chosen to characterize the different physical quantities were the following: the equivalent temperature for thermal environment, vibration total value for the accelerations, the continuous equivalent sound level for noise, the carbon dioxide

concentration for air quality and the illuminance for the lighting. A total of 530 subjective evaluations were collected regarding the environmental discomfort, through a questionnaire where passengers should point out, by the end of each journey, their feelings of discomfort regarding the thermal environment, vibration, noise, air quality, lighting and the evaluation concerning the global discomfort level.

A human response model was developed through either a linear multiple regression or a neural network, being an artificial neural network chosen as the one that best adapts the human response. The model may be considered as a virtual passenger, who uses the obtained relations between the several physic parameters and the partial discomfort rates, in a way that these represent the input parameters of neural network, thus obtaining the global discomfort average level, through the different measured physical quantities.