

Influence of noise and Testing vibration to comfort in diesel engine cars running at idle.

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Abstract - It allows that a subject can be placed on a car seat excited in the vertical direction; the subject also has his hand on a vibrating steering wheel and can hear noises through headphones. Thus a realistic simulation of the environment of the driver of an engine car running at idle is possible. After measurements on six cars, three paired comparison tests have been conducted. In the first one, the test person is only exposed to noise. In the second one, he/she is also exposed to vibrations measured in the cars, but he/she is always asked to evaluate only sounds. In the third one, he/she is then asked to evaluate the overall annoyance of the situations while being exposed to all stimuli. The comparison between the results of the first two tests proves that vibrations have an influence on sound perception in a small but significant way. In the third test, the jury can be separated in two groups of people using different criteria for the first one, the overall annoyance is only related to the vibratory stimuli, whereas in the second one noise stimuli are also important for the evaluation.

but the frequency of the disturbing force should not be at, or near, a natural frequency of the structure otherwise resonance will occur, with the resulting high amplitudes of vibration and dynamic stresses, and noise and fatigue problems. There are two basic types of structural vibration: steady-state vibration caused by continually running machines such as engines, air-conditioning plants and generators either within the structure or situated in a neighbouring structure, and transient vibration caused by a short-duration disturbance such as alorry or train passing over an expansion joint in a road or over a bridge.

Vibration testing for qualification, product verification, and R&D are not only beneficial for the reliability of products, but often required of component manufacturers by vehicle OEMs. Data Physics offers a full array of vibration test systems for durability test and vibration test. Whether the application is with combined thermal testing or on a standalone shaker, Signal Force Electrodynamic Shakers and Signal Star Vibration Controllers used together are the vibration test system of choice for many automotive and vehicle industry leaders.

Key Words: Vibration, Influence, Stimuli, Noise.

1.INTRODUCTION

The vibrations are inseparable phenomena during operating and driving by all means of transport Vehicles in motion are forced to vibration mainly by the road. There are many of different vibration sources in vehicles as well. Some of them are main source of vibration during operating but without any movement. The motor engine should be considered as one of the most important vibration generator when the car doesn't drive. In order to examine vibration related phenomena. Occurring in a moving vehicle or a stationary one with its engine on, one should start with identification of vibration sources. Vibration sources in a vehicle are dynamic forces but also free vibrations as well as forced, self-induced, parametrical, non-parametrical, random and stationary ones, all generated by the driving unit, the power transmission system and the road. Due to the properties of vibration related phenomena they may be analysed from the perspective of diagnostics degradation and impact on men.

1.1 VIBRATION OF CAR VEHICLES AND HUMAN PERCEPTION

During operating of vehicles there are many vibration generated by the different sources. Motor engine should be considered as the vibration generator as well. This kind of machine generate a disturbing force of one sort or another,

1.2 Perceptual tests

It had been decided to carry out three tests in order to reach the objectives of the study (assessment of the vibration interaction on sound evaluation and of the contribution of each modality for global annoyance)

-In the first one (called test 1 later on), a subject sitting on the bench was only submitted to the acoustic stimuli ; his task was to compare noise comfort of the stimuli.

- In the second one (test 2), he was submitted to all the stimuli (acoustic and vibratory ones), but his task still was to only assess sounds. The comparison between the results obtained in this test and the previous one had to give indications on the influence of vibrations on the evaluation of sounds.

- Lastly, in the third test (test 3), a subject, submitted to all stimuli had to assess the global comfort of his situation. An individual successively took part to these three tests, in an order which was balanced between the different test persons so as to suppress any range bias.

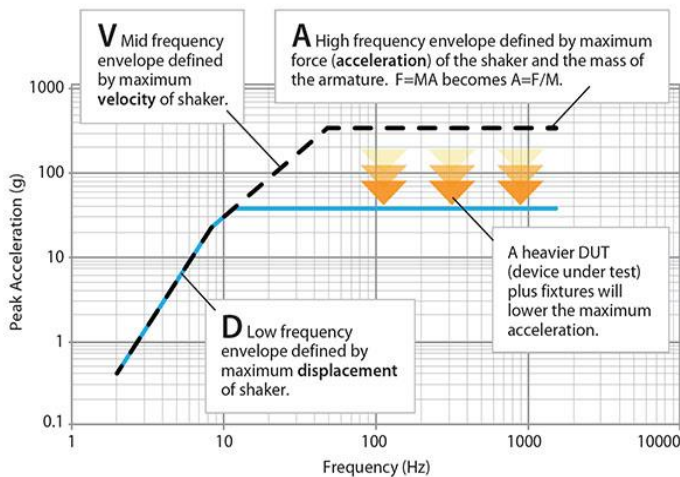
2. Research

Data Physics is a global supplier of complete vibration test systems including vibration shaker tables, shakers, power amplifiers, slip tables, head expanders, custom fixtures, vibration controllers, and dynamic signal analyzers. This complete range of vibration test equipment makes Data Physics an ideal partner for nearly any vibration testing application.

All Signal Force products and vibration test systems, or vibration shaker systems, including high quality accessories such as head expanders and slip tables, are manufactured in the USA or the UK by Data Physics.

Electrodynamic (ED) shakers are well suited for most vibration tests and offer several advantages over alternative approaches. Compared to hydraulic shakers, ED shakers are capable of much higher frequencies. These high frequencies can be very important in testing electronics and electronic assemblies. ED shakers are also capable of reproducing a wide range of shock and SRS pulses in addition to general vibration testing. Lastly, ED shaker have very linear behaviour, so controlling the vibration test may be easier or possible when not otherwise possible.

Choosing the Correct Shaker for a Testing Application:
The graph below is a generic (frequency domain) performance envelope for any shaker, as defined by its maximum displacement, maximum velocity, and maximum force

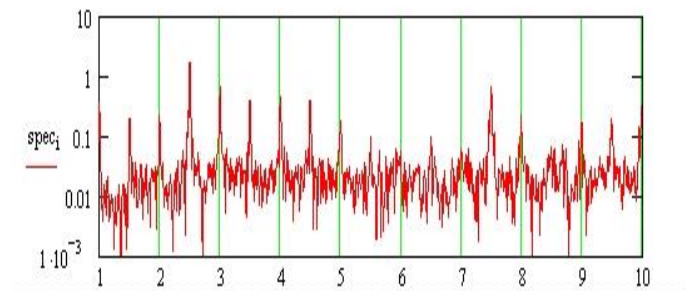


NVH (NOISE VIBRATION & HARSHNESS)

Noise, vibration, and harshness (NVH), also known as noise and vibration (N&V), is the study and modification of the noise and vibration characteristics of vehicles, particularly cars and trucks. While noise and vibration can be readily measured, harshness is a subjective quality, and is measured either via "jury" evaluations, or with analytical tools that can provide results reflecting human subjective impressions. These latter tools belong to the field known as "psychoacoustics."

In some cases the NVH engineer is asked to change the sound quality, by adding or subtracting particular harmonics, rather than making the vehicle quieter. Many problems are generated as either vibration or noise, transmitted via a variety of paths, and then radiated acoustically into the cabin. These are classified as "structure-borne" noise. Others are generated acoustically and propagated by airborne paths. Structure-borne noise is attenuated by isolation, while airborne noise is reduced by absorption or through the use of barrier materials. Vibrations are sensed at the steering wheel, the seat, armrests, or the floor and pedals. Some problems are sensed visually - such as the vibration of the rear-view mirror or header rail on open-topped cars. NVH can be tonal such as engine noise, or broadband, such as road noise or wind noise, normally. Some resonant systems respond at characteristic frequencies, but in response to random

The x axis is given in terms of multiples of engine speed. The y axis is logarithmic, and uncalibrated excitation



Result-

There are three principal means of improving NVH: Reducing the source strength, as in making a noise source quieter with a muffler, or improving the balance of a rotating mechanism. Interrupting the noise or vibration path, with barriers (for noise) or isolators (for vibration). Absorption of the noise or vibration energy, as for example with foam noise absorbers, or tuned vibration dampers. Deciding which of these (or what combination) to use in solving a particular problem is one of the challenges facing the NVH engineer

3. Conclusion

Interactions between sound and vibration is certainly a complex phenomenon, depending upon the relative levels should be considered with care, because they depend on the range (if not on the spectra) of the stimuli used in the experiment. It would be helpful to study that interaction in an exhaustive way, in order to improve knowledge about it and to evaluate its importance in the different practical conditions in which it can be present. Nevertheless, this study shows that vibrations are very important in the evaluation of comfort by car drivers, which can make necessary the use of mechanical benches to reach a realistic sub-frames, balancing, modifying the stiffness or mass of structures, retuning exhausts and intakes, modifying the characteristics of elastomeric isolators, adding sound

deadening or absorbing materials, or using active noise control. In some circumstances, substantial changes in vehicle architecture may be the only way to cure some problems cost effectively.

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