Research on the Controllability of the Sound Wave of Automobile Whistle Combining Computer Technology and Sound Dispersion Mechanism

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Abstract. At present, the popularity of cars has brought great convenience to our life, but at the same time it has brought about many bad effects, such as noise pollution caused by the sound of car horns. Therefore, it is very important for us to study the controllability of car horn, and the mature development of computer technology provides us with the research conditions and convenience. In this paper, the controllability of sound wave of car horn in two-dimensional space is studied by combining computer technology with sound diffusion mechanism, and a kind of noise thermometer invented by American scientists is taken as an example.

Keywords: Spatial Controllability, Car Horn Sound, Sound Propagation and Diffusion

1. Introduction

Noise refers to the sound produced by the speaker when it vibrates irregularly. Sound is produced by the vibration of an object and propagates in a certain medium (such as solid, liquid and gas) in the form of waves. Generally speaking, noise pollution is caused by people. From the physiological point of view, all the noises that disturb people's rest, study, work and the sounds you want to hear, that is, unwanted sounds, are collectively called noise. When the noise has a bad impact on people and the surrounding environment, it will cause noise pollution. Since the industrial revolution, the creation and use of various mechanical equipment has brought prosperity and progress to mankind, but at the same time, it has also produced more and more strong noise. Noise can not only damage hearing, but also induce a variety of cancer causing and fatal diseases, and also interfere with people's life and work [1].

(1) Traffic noise includes noise from motor vehicles, ships, subways, trains, airplanes, etc. Due to the rapid increase of the number of motor vehicles, traffic noise becomes the main noise source of the city.
(2) Industrial noise noise produced by various equipment in a factory. The sound level of industrial noise is generally high, which has a great impact on workers and surrounding residents.

(3) The construction noise mainly comes from the noise of construction machinery. Building noise is characterized by high intensity and occurs in densely populated areas, which seriously affects the rest and life of residents.

(4) Social noise includes the noise from people's social activities, household appliances and audio equipment. Although the noise level of these devices is not high, they are closely related to people's daily life, which makes people not quiet at rest, especially annoying and easy to cause neighborhood disputes.

2. Noise classification

2.1. White noise

The energy of each frequency point of white noise in the whole spectrum is constant and basically constant. No matter the signal is processed by low-pass filter or high-pass filter, white noise cannot be effectively filtered, because it exists in the whole frequency range. White noise is random, it has no correlation, so there is no deviation. Therefore, white noise can be superimposed on the signal and algorithm, or always exist in the analog-to-digital converter, without long-term error. Through proper processing, white noise can also be used to create sounds, including human and natural sounds, and even to synthesize other noises[2].

Human beings have a good understanding of white noise and can extract a lot of useful information skillfully. White noise even has medical functions. Some medical experts (mainly physicians and dentists) have also successfully applied white noise to mild anesthesia.

Generally speaking, white noise can be generated by random number generator, but experiments show that it is difficult to generate ideal white noise, and the synthesis of other noises is similar to this.

2.2. Pink noise

In a given frequency range (excluding DC component), with the increase of frequency, the power density decreases by 3 dB per octave (the density is inversely proportional to the frequency), and the power of each octave is the same, but it is very difficult to produce a 3 dB per octave attenuation, so it is difficult to find pink noise without ripple in reality. Pink noise is very useful for measuring the frequency response of audio equipment and determining the room amplification application.

2.3. Red noise

Red noise comes from the concept of Oceanography. This is a kind of noise related to the marine environment. Because it selectively absorbs a higher frequency, it is called red noise.

2.4. Orange noise

This kind of noise is quasi-static. In the whole range of continuous spectrum, the power spectrum is limited and the number of zero power narrow-band signals is limited. These zero power narrow-band
signals are concentrated on the note frequency center of any correlation note system. Since all consonants are eliminated, these remaining spectra are called "orange" notes [3].

2.5. Blue noise

In a limited frequency range, the power density increases by 3 dB per octave (the density is proportional to the frequency)[4].

2.6. Purple noise

In a limited frequency range, the power density increases by 6 dB per octave (the density is proportional to the square of the frequency).

2.7. Gray noise

This noise is similar to the isoloudness curve (such as the reverse A-weighted curve) in psychoacoustics in a given frequency range, so the noise level is the same at all frequency points.

2.8. Brown noise

In the limited frequency range without DC component, the power density decreases by 6 dB per octave (the density is inversely proportional to the square of frequency) with the increase of frequency. This noise is actually generated by Brownian motion, which is also called random drift noise or drunk noise.

2.9. Black noise

Also known as "static noise". In the limited frequency range above 20000 Hz, the noise with constant power density is similar to ultrasonic white noise to some extent. This kind of black noise is like "black light", which is too high to be perceived, but it still has an impact on you and your surrounding environment[5].

3. Prevention and control of noise pollution

In order to prevent noise, Professor Ma Dayou, a famous Chinese acoustician, once summarized and studied the hazards and standards of various kinds of noise at home and abroad, and put forward three suggestions (As Figure 1):
Car Horn Noise Control

Administrative Control

Technology Control

Noise Reflecting Wall

Tidal Lane / One-way Limited

Car Whistle Photography

Transportation Bureau

Urban Management Bureau

Traffic Police

Vehicle Administrative Office

Noise Data Warning

Figure 1. Control scheme of car whistle noise

(1) In order to protect people's hearing and health, the allowable value of noise is 75-90 dB.

(2) Ensure conversation and communication. The allowable value of environmental noise is 45-60 dB.

(3) For sleep time, 35-50 DB is recommended.

In buildings, the main measures to reduce noise are sound insulation and absorption.

Noise control includes:

(1) To reduce the noise of sound source, industry and transportation industry can choose low-noise production equipment and improve production technology, or change the movement mode of noise source (such as damping, vibration isolation and other measures to reduce the vibration of solid sound generator)[6].

(2) In the way of sound transmission, we should reduce noise, control the spread of noise, change the way of noise transmission that the sound source has already sent out, such as adopting sound absorption, sound insulation, sound barrier, vibration isolation and other measures, as well as reasonably planning the layout of cities and buildings.

(3) For the protection of the noise of the recipient or the organ, if the measures cannot be taken in the sound source and transmission way, or if the acoustic measures taken still cannot achieve the expected effect, it is necessary to take protective measures for the recipient or the organ. For example, workers exposed to long-term occupational noise can wear ear plugs, earmuffs or helmets and other ear protectors.

① The energy of sound in the propagation is attenuated with the increase of distance, so the noise source can be far away from the quiet place, which can achieve the purpose of noise reduction. ② The radiation of sound generally has directivity. When it is located at the same distance as the sound source
and in different directions, the received sound intensity is different. However, when most sources radiate noise at low frequency, the directivity is very poor; with the increase of frequency, the directivity increases. Therefore, controlling the propagation direction of noise (including changing the emission direction of sound source) is an effective measure to reduce noise, especially high-frequency noise. ③ Establish sound insulation barriers, or use natural barriers (earth slopes, hills), and other sound insulation materials and structures to block the transmission of noise. ④ By using sound-absorbing materials and structures, the sound energy of noise in transmission is transformed into heat energy, etc. ⑤ In urban construction, reasonable urban noise prevention planning is adopted. In addition, vibration isolation measures are taken to reduce the noise propagation.

4. Summary

Therefore, as long as the applied voltage is known, this instrument called the collection noise temperature (SNT) can measure the temperature. The researchers say the SNT can be accurate to one thousandth of a degree at -272.15 degrees Celsius, five times the accuracy of a thermometer used to measure near absolute zero. The biggest advantage of this new design is that it is an original thermometer: no external calibration is required. This is because the relationship between voltage, noise and temperature only depends on the most basic physical constant. In addition, the accurate temperature measurement range of this instrument is much larger than other thermometers. So the researchers say their SNT "may have a wider range of uses than the direct thermometer now in use.".

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