

A Study on the Analysis of Automobile Suddenly using an Acoustic Signal Analysis

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Abstract

In this paper, we analyze acoustic characteristics of a sudden drive in a variety of automobiles in recent years to distinguish characteristics of various mechanical noise and ambient noise. Through this acoustical analysis, we analyze the reason for the sudden emergence by understanding the acoustic characteristics of the sudden automobile and understanding the sounds with mechanical characteristics. These studies have shown that they exhibit different characteristics from mechanical sounds that are caused by mistakes by anthropomorphic manipulation. In the future, it will help to understand much more about the identification of sudden emergence by converting the various waveform features to dB. Analysis of the characteristics of the mechanical sound has difficulties with time domain analysis because it has to be distinguished from various noise signals around. In this study, we can analyze these characteristics in the frequency domain and analyze various parameters. Therefore, we focused on analyzing the features on the spectrogram. The characteristics of the anthropomorphic sounds are irregular, while the mechanical sounds of the sudden sounds show a constant steep slope, and the sound pressure of the frequency changes. This feature is a research analysis of this paper because it has a certain characteristic slope because it cannot be artificially created in mechanical operation.

Keywords: Frequency, Mechanical characteristics, Acoustic characteristics, Noise signal

INTRODUCTION

As society and science and technology developed, the means of transportation have been constantly evolving. As the means of transportation evolve, the area of people's work is widened and the travel time is saved, allowing the busy people to do a lot of work. Today it is quite natural to use cars to move places in everyday life. However, automobile accidents are increasing with the increasing use of automobiles, and accidents caused by sudden emergencies are increasing

rapidly every year. However, it is still difficult to find the cause of the sudden acceleration of the car, so many victims of sudden accidents are not receiving the proper compensation and are handling the damage and responsibility alone. This is because when a sudden accident victim raises a problem with an automobile manufacturer, the manufacturer collects the EDR (Event Data Recorder) installed in the automobile and dismisses the fact that there is no defect in the automobile through the result of the self-analysis.

Part of this conclusion can be supplemented by further analyzing the acoustic signal. A variety of acoustic signals can appear anywhere, but because the car is moving mechanically, the signal appears more clearly. By performing this supplementary role, more precise analysis will be made.

Therefore, in this paper, in order to investigate whether the sudden phenomenon is due to driver's inactivity or internal defect in the car, the sound signal which is present in the increasingly used black box is displayed and the stored engine sound and various mechanical sounds. The composition of this paper is as follows. In Chapter 2, we explain about automobile hurdling. In Chapter 3, we analyze the rush through sound analysis and conclude in Chapter 4.

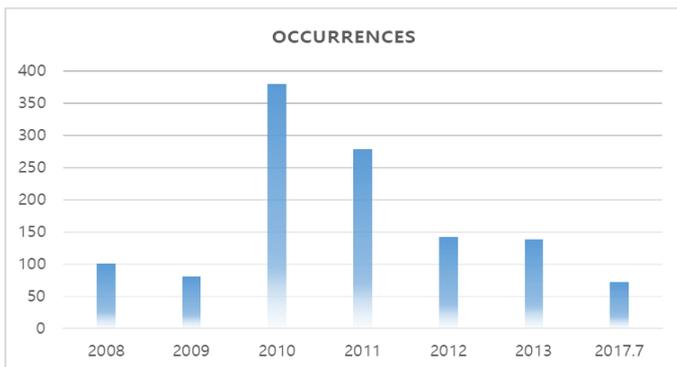
STATUS OF SUDDEN ACCIDENT

A car suddenly refers to a phenomenon in which an automobile deviates from a driver's control range and thus speeds up abnormally. Every year, sudden reports of such sudden emergencies are rising, but there are still many opinions among experts. Experts are making various claims as a cause of the sudden acceleration, and one of the causes of the sudden emergence in many experiments is that an engine control unit (ECU) operation error occurs for some reason and the throttle valve becomes uncontrollable. At this time, the throttle valve controls the amount of air flowing into the engine, and the accelerator pedal controls the opening degree of the valve. As the accelerator pedal is depressed, the valve opens more and more. However, when the accelerator pedal is

depressed, the throttle valve becomes out of control, so that a large amount of air is continually introduced, resulting in an abnormally increased speed. At this time, even if the driver presses the brake pedal, the throttle valve is already opened so that the speed does not decrease.

Recently, as the tendency to install black boxes for automobiles has increased, there has been an increasing number of cases in which the video of the sudden claims is presented as evidence for the cause, but there is a limit to the identification of the brake operation of the driver. Table 1 shows the number of consultation cases related to sudden emergencies received by the Consumer Protection Agency. The types of car rapidity are as follows. In a total of 101 cases of sudden claims, 32 cases (31.7%) occurred in the process of stepping on the brakes or repeating forward and backward movements in order to make a turnaround or turn, 23 (22.8%), 20 (19.8%), 16 (15.8%), and 10 (9.9%) in the process of departing after stopping or stopping. [1]

Table 1: Case of Consumer Telecom Consultation by Vehicle Sudden Emergency Year[1]



CAUSES AND EXPERIMENTS

The engine control unit (ECU) inquires the preset ignition timing map (MAP) value and the fuel injection MAP value, such as the engine revolution number, the intake air amount, the intake pressure, the accelerator opening degree, Calibrate the sensor and adjust the opening and closing rate of the injector. In this way, the fuel injection quantity and ignition timing are determined. [2] However, if an abnormality occurs in the engine control unit, it will cause a sudden acceleration. [3] In other words, malfunctions can be caused by defective ECU components, poor soldering, deformation of the circuit board, etc. [3]

Today's vehicles are said to be equipped with ECUs from four to as many as 40. The higher the number of cars, the more the number increases. It is reported that unstable voltage causes malfunction. [3] When a sudden acceleration occurs, the driver hears an engine acceleration sound that he / she does not want / from a certain distance to a certain distance, which

causes anxiety. This sound component starts from 40Hz to 160Hz and causes a rapid change sound and a large harmonic tone, which causes a psychoacoustic tension. Therefore, in order to prove a sudden start, it is necessary to turn on the sound recording function when the black box is operated normally, and it can be an important clue to indicate whether or not the engine sound in the black box is suddenly accelerated or accelerated.

Figure 1 shows the trajectory of a suddenly increasing sound in the early part of a sudden on the sound source recorded in the vehicle where the suddenly occurred. In the case of sudden emergence, the RPM increases sharply in the initial short period of time, thus showing the trajectory on the spectrogram. Figure 2 is a flow chart for detecting a sudden jump. I analyzed the frequency of the frame when the driver did not step on the accelerator pedal. If there is a noticeable peak of 100 ~ 200Hz, the maximum output of the engine may occur. Therefore, if the data stored in the buffer moves to three to five previous frames and an initial noise is detected, a sudden onset is considered to have occurred.

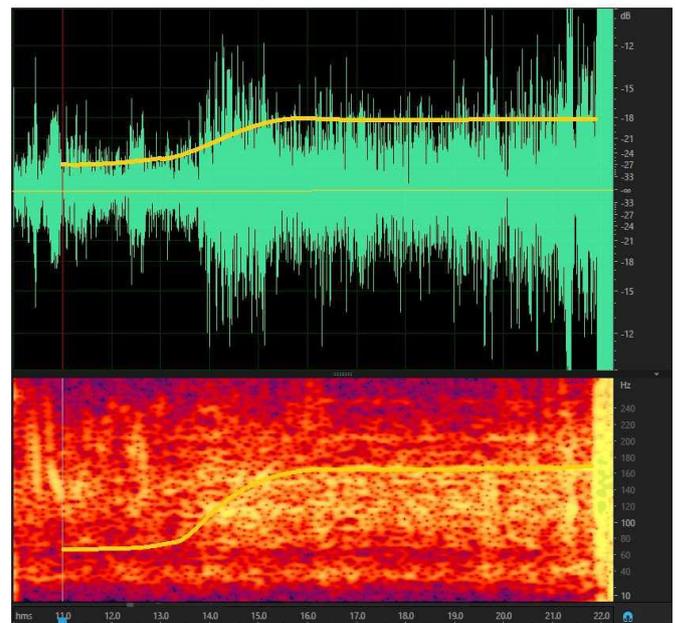


Figure 1: Spectrogram where a sudden occurrence occurred

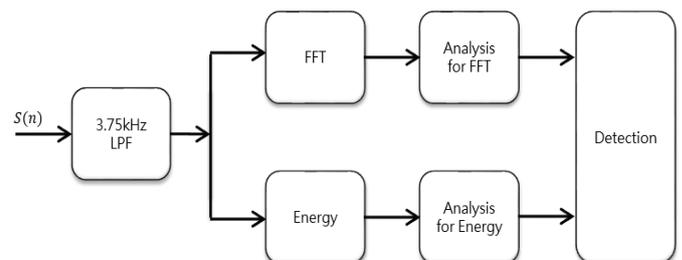


Figure 2: Flow chart of Sudden Accident

In Figure 1, we can see that the RPM is maintained at the maximum value for 2 seconds if we look at the characteristics of the rapidity. This is artificially driven by a fast-accelerator pedal or by a mechanical feature where the slope of the RPM represents a regular curve.

CONCLUSION

If a sudden suspicion occurs, the driver becomes a victim and, at the same time, rushes to the other vehicle or nearby passers-by, and the building, and suffers a very unharmed situation. In this paper, we propose a detector to detect the sudden acceleration by analyzing sound source of black box engine sound in order to identify suspicious accidents and minimize damage caused by accident. Analysis of the sudden doubt black box sound source shows the trajectory of the sound which increases sharply in the initial part. In this case, RPM rapidly increases in a short period of time in the case of sudden emergence, and it is confirmed that the locus appears on the spectrogram. The results of the experiment show that the possibility of identifying the rapidity of the black box sound source can be verified. In order to prevent suspicions that are rapidly increasing every year, a sudden detection detector is installed in the vehicle to induce a warning sound. A method is needed.

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