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A Study on Individual Frequency Bandwidth using Addition Signal in Noise Signal

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***Abstract*—This paper proposes different ways to study individualized bandwidth. This bandwidth is used in noise signal for recognition and analysis in various ways but previous methods only apply weighted dB(A) and dB(C) to sound pressure level or one in low frequency scope. Also, there are A weight sound level (L_A), NC curve (Noise Criteria Curves), and NR curve (Noise Rating Curves). This research tries to find out about individualized bandwidth by using frequency bandwidth and applying this to different fields such as recognition, analysis, and reduction.**

Keyword-Individual frequency, Bandwidth, Formant

I. INTRODUCTION

In modern society, people′s interests in well-being is increasing as their quality of life is developed. Having a clean environment and preferring to keep body healthy are similar context as well [1]. From this point, the most known issue is noise. Noise is defined as a sound that is not helpful to the listener. In sound processing field, study on individualized bandwidth using recognition information such as clarity of sound quality has been carried out. However, such studies are not applicable to fields like noise. Therefore, if database on customized bandwidth based on individual noise is applied to our daily life, it will be a good tool for finding types of noise. This is because the method used for figuring out noise is similar to one that used for recognizing and checking types of noise. What is more, this is also applicable to reducing noise after diagnosis.

Especially, as this research makes database based on frequencies on frequency spectrum with unique features instead of adopting general method of calculating parameters it will be a very useful factor. The composition of this research as follows. In Chapter 2, it looks into how general parameters used in general noise are found and their features. In Chapter 3, it discusses about study method on finding individualized bandwidth by using proposed addition signal. Lastly, Chapter 4 is makes the final conclusion and offer the future research directions.

II. CHARACTERISTICS OF ADDITION SIGNAL IN SPEECH

Generally when identifying recognition on noise or types of noise it is done by transferring data to frequency scope and giving weighted value to separate it into low frequency and high frequency. The most commonly used parameters are dB(A) and dB(C), weighted value added to dB value. dB(A) is a sound unit representing auditory features of human and it is widely used in daily life such as noise unit. dB(C) is used for measuring low frequency and its feature is that it has a wide range from 100Hz to 6 octave. It is also used for analyzing frequency and has almost similar frequency with dB SPL in audible scope. Other methods include A weight sound pressure level (L_A), NC curve (Noise Criteria Curves), and NR curve (Noise Rating Curves). However, these methods provide accurate noise standard when measured in response to each situation but they have different standard weight value and energy size can be known only in units of dB or phon. Therefore, factors for identifying typical characteristics of noise as well as colors are required [2]. To differentiate noise features, they are converted to frequency and then, weight value is fixed to each frequency to measure the noise.

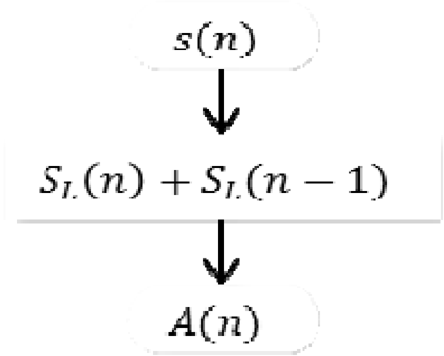
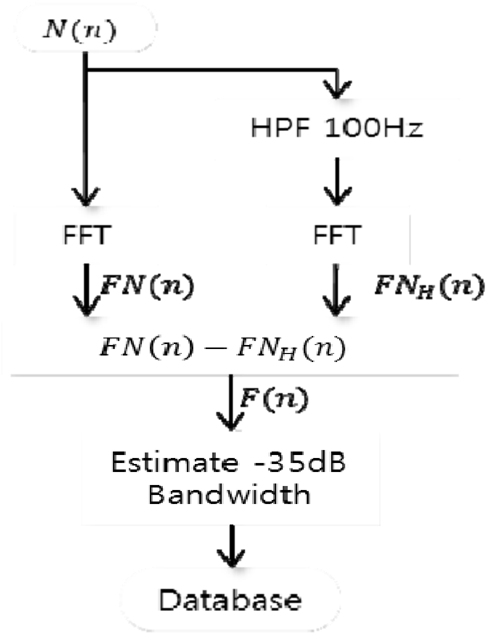


Figure 1. Define of an addition signal

As these methods are processed based on the origin of sound it is difficult to show its unique feature and also changes greatly depending on the environmental variables, resulting in limitation of making a database. As this limitation has difficulties of showing size and strength of noise sources which are features of low frequency factors and thus, this research paid more attention to making a detailed database based on characteristics of addition signal.. The Fig. 1 shows how to extract signals from addition signal. Identifying unique features or colors of noise can be used as an important factor for having a customized noise recognition by turning individual parameters more delicate and detailed.

III. Proposed Methods

Therefore, based on maximum profit of sound converted to frequency scope which is –35dB, frequency bandwidth on measuring point is calculated. Bandwidth calculated from this formula provides important information depending on materials and condition of noise sources and this information is vital for recognizing or identifying noise [1]. Fig. 3 shows a map of customized bandwidth using addition signal. Before making a database for input signal, original signal and addition signal are divided to make sound source data. Therefore, addition signal is calculated from input signal to make two-step signals. Using 100Hz HPF first is to filter low frequency factors in original signal.



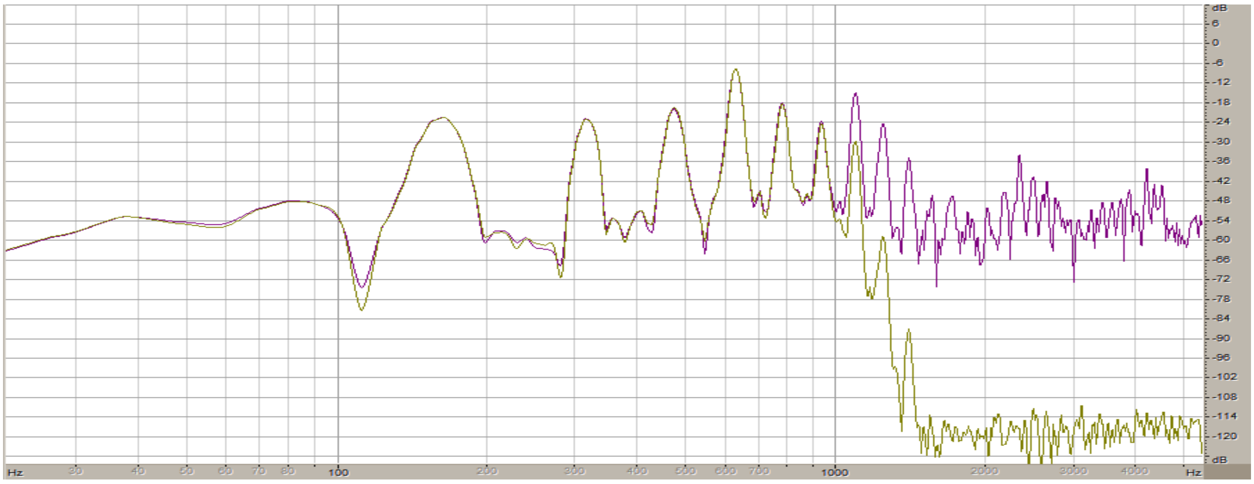
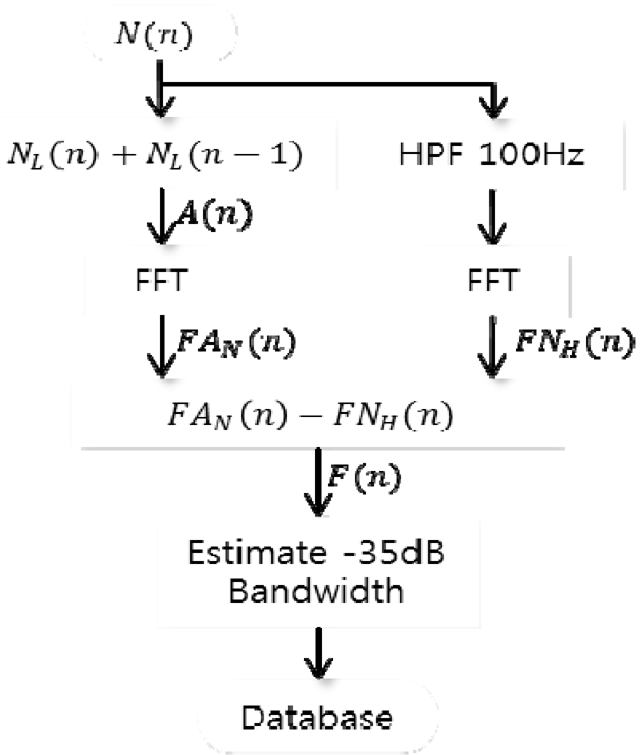


Figure 2. An existing flow chart for individual frequency bandwidth

From this filtered signal, difference between addition signal and signal is calculated to remove low frequency factors. As addition signal emphasizes low frequency factors application of this may well present frequency factors depending on size and strength of noise source. Before making a database, it is converted to frequency scope and made into a database by using the following comparison method. Generally, noise signal, known as input signal is defined to have no loss energy of $N(n)$. However, signal filtered from 100Hz through cut-off frequency has only high frequency information as it filters only high frequency ones. Calculating difference between these two signals make signal that has features of frequencies under 100Hz. They also confirmed level of dB value but now, they contain recognition information as important parameters. Here, the maximum profit (0dB) is set as a standard and at –35dB, bandwidth is measured and made into a database [2].

Experiment done by proposed method as follows. Input signal N(n) in Fig. 4 used noise sources from dehumidifier, humidifier, refrigerator, hair dryer, and big fan. Sampling data of noise signal was 11kHz and was collected at 16 bit.



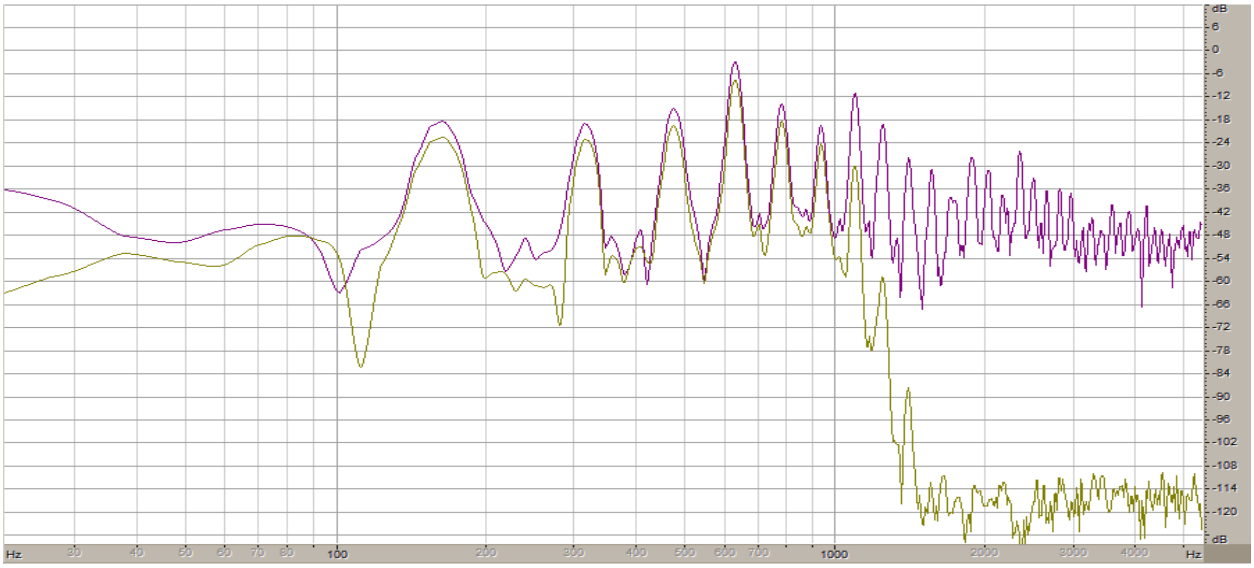


Figure 3. A proposed flow chart for individual frequency bandwidth

IV. CONCLUSION

This research studies changes in customized bandwidth which emphasizes low frequency by using addition signal. So far, compared to measuring information with weighted value, factors for identifying clarity and color are widely used, which is an important information for individual tone. In the future, this information will be an important standard for acquiring information on recognition and reduction of noise. What is more, this can be used as a new parameter. a database applicable to time changes can be built by predicting materials and conditions of more individual features.

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