

# SOUND CODECS' SPECTRAL PERFORMANCE

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## INTRODUCTION

Sound codecs' goal is to provide the selected sound file in a much smaller file without any loss from the quality. In order to achieve this, different sound codecs use different algorithms to process sound files. But during the transformation of the algorithm, a certain quality loss occurs because of the nature of the algorithms: to erase data so that human ear cannot distinguish between a complete sound stream and a processed sound stream. The objective of this study is to find the loss properties of each sound codec by a power spectral density analysis of the sound signals and to determine (if there is a need for) the best alternative to MP3 which is the most popular sound codec among casual listeners.

## METHODOLOGY

The original sound file obtained from a CD is transferred to the hard disk in WAV format. WAV files are encoded to MP3, OGG and WMA formats. MP3, OGG and WMA files are decoded back to the WAV format. WAV files are transferred to Matlab as signal data. A power spectrum analysis is made for each signal. The frequency characteristics of the codecs are determined from these spectrum analyses (Figure 1). A "percent difference" algorithm has been written to calculate percent deviations of the spectrum of converted sound files from the original sound file for a specified frequency interval. The results show the performance of the codecs in their frequency ranges (Figure 2).

## RESULTS

	MP3	OGG	WMA
<b>Spectrum Range</b>	20Hz – 14200Hz	20Hz – 19000Hz	20Hz – 17500Hz
<b>%deviation from original</b>			
<b>0Hz – 7500Hz</b>	Max 15%	Max 15%	Max 15%
<b>7500Hz – 15000Hz</b>	15% < 13500Hz 100% > 14200Hz	70% average	Max 15%
<b>15000Hz – 22050Hz</b>	Out of range	Random consistency between 0% and 180%	Linearly increasing up to 17500Hz

## CONCLUSION

Although OGG's frequency range is the largest of all, its deviation from the original spectrum performance is not good compared to the other two codecs. MP3 works adequately well between the range 20Hz and 13500Hz. WMA also works adequately well in MP3's frequency range, but it also continues its performance up to 15000Hz, and slowly gives up from its quality till 17500Hz. More analysis can be performed to measure the deviation from

the original capacities of the codecs by analyzing different bit ratios other than 128kbps. At the end of this analysis though, WMA sound codec can be recommended for 128kbps CBR.

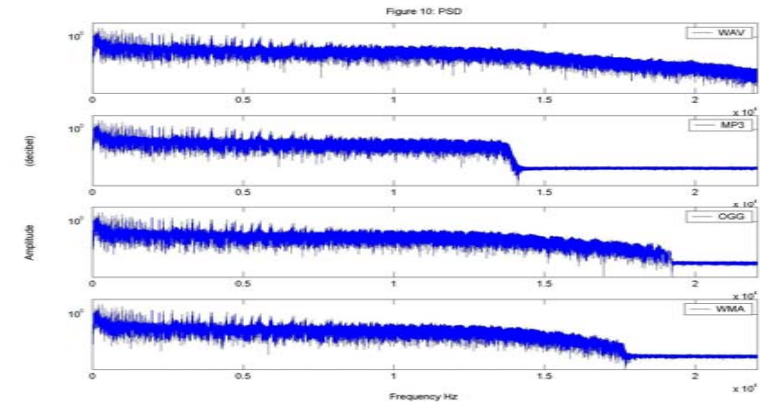


Figure 1: Power Spectral Densities of the codecs

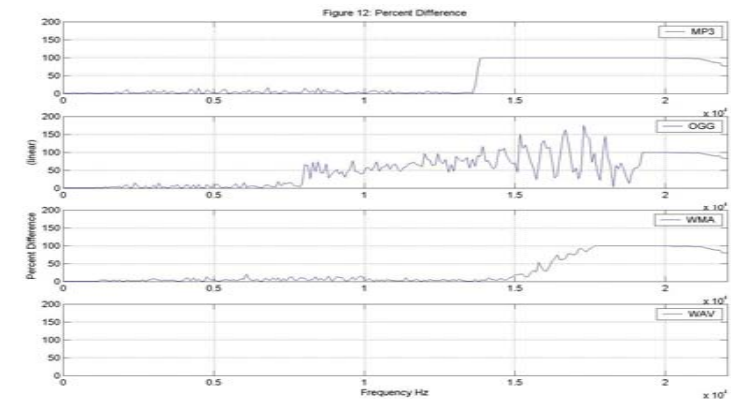


Figure 2: Percent Difference of the codecs

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