

ADSP TFA & ASP Report

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Jun. 17, 2024

Question 2.1

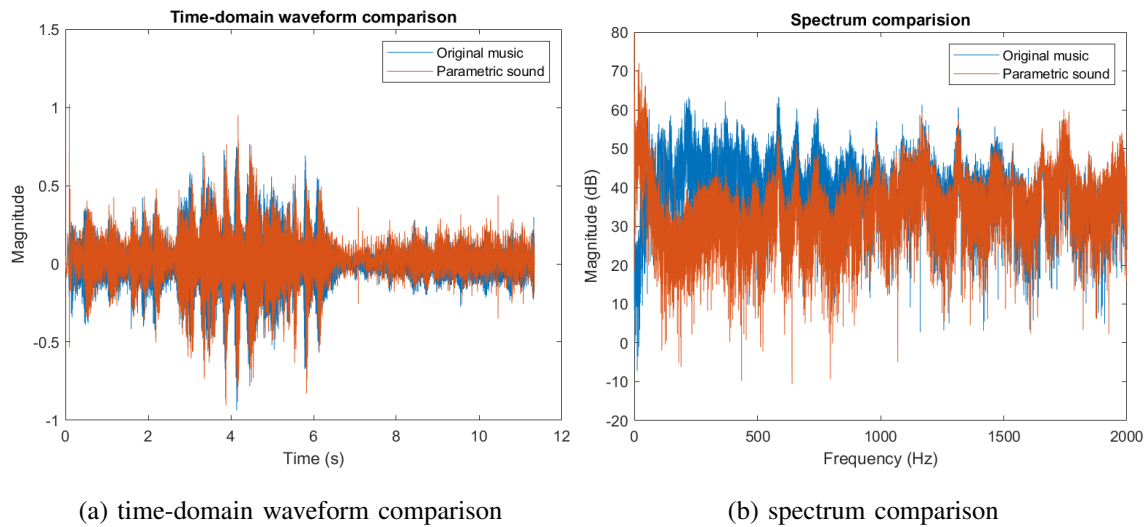


Fig. 1: Comparison between 2 voices

The left figure above (1a) shows a time-domain waveform comparison between the original sound and the parametric sound. As illustrated, the two waveforms appear almost identical, making it challenging to distinguish or describe any differences between them.

In contrast, the right figure above (1b) presents a spectral comparison of the original sound and the parametric sound. It is evident that there is a significant difference in the low-frequency range, where the two sounds are nearly opposite to each other. However, in the high-frequency range, the similarities between them become more apparent.

Question 2.2

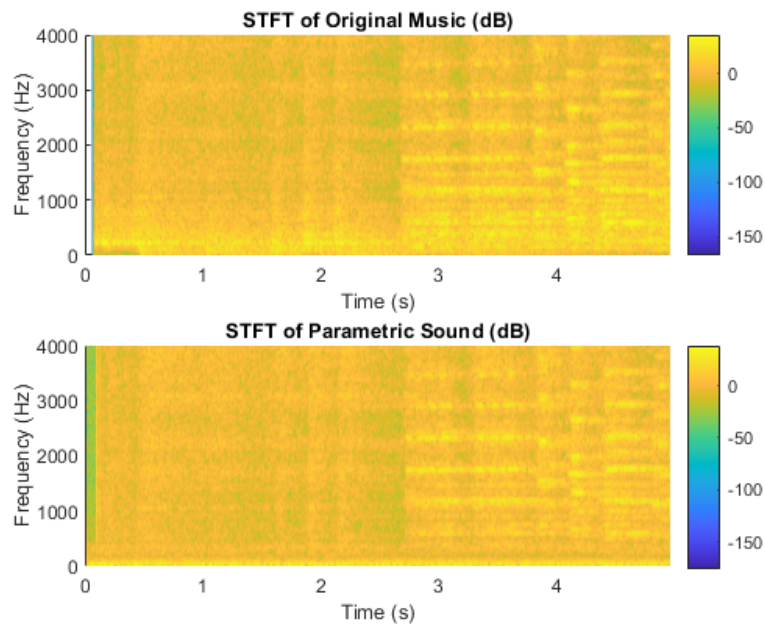


Fig. 2: STFT of the original and parametric sounds with window length 1024

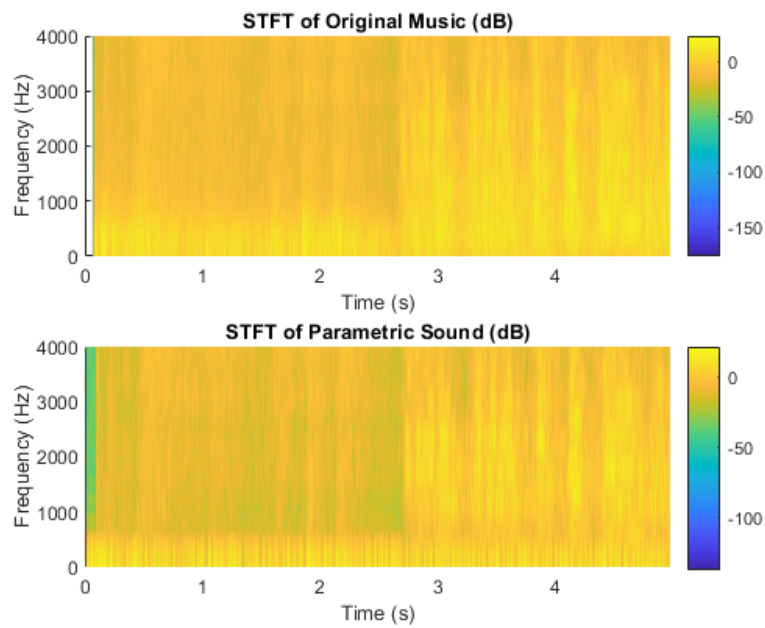


Fig. 3: STFT of the original and parametric sounds with window length 128

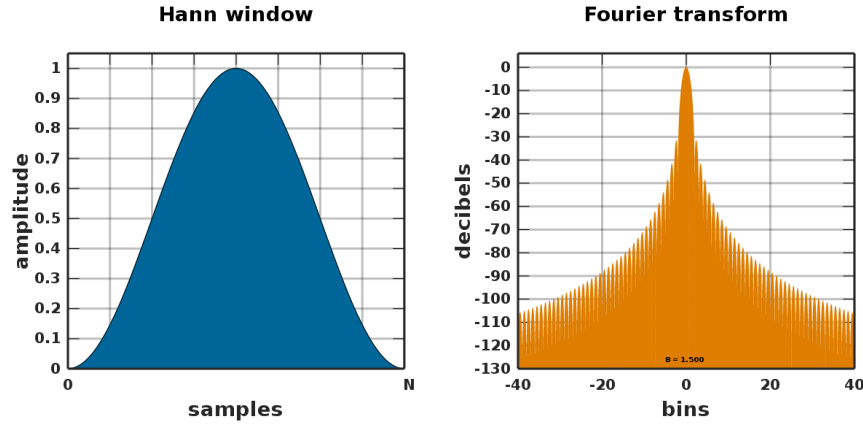


Fig. 4: Hann function (left), and its frequency response (right) (source: wiki)

setting	variable	value
window size for STFT	w_len	1024 & 128
Windowing function	win	Hann window
FFT length for STFT	fft_len	2048
Overlapping window length between two STFT analyses	OverlapLength	512 & 64

TABLE I: The settings of STFT

The table above (I) details the settings used for STFT analysis, including (1) window size, (2) windowing function, (3) FFT length, and (4) overlapping window length.

I used two different window lengths, 1024 and 128, to observe varying frequency-time relationships. In Figure (5), which employs a window length of 1024, a notable difference in low frequencies is apparent regardless of time. Conversely, Figure (3), using a window length of 128, exhibits a similar phenomenon, although with jaggedness in the low frequencies. However, in the high frequencies, both figures show nearly identical results.

Comparing the two figures using window lengths of 1024 and 128, it is evident that the first figure exhibits higher frequency-domain resolution but lower time-domain resolution compared to the second figure. This observation aligns with our initial findings.

Question 2.3

Observe the STFT figures of the original and parametric sounds; there is a significant difference between them. To address this, I used a Butterworth band-pass filter to first filter out the low-frequency components of the parametric sound. Then, I linearly combined the filtered version with the original parametric sound. This process made the parametric sound more similar to the original one.

The figure below shows the STFT of the original sound compared to the improved version. It can be seen that the improved version is more similar to the original sound than the parametric version.

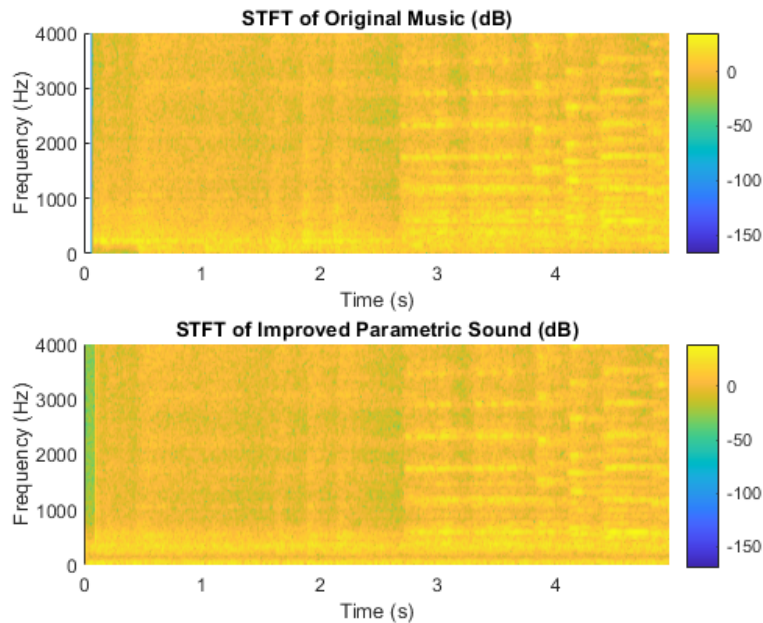


Fig. 5: STFT of the original and parametric sounds with window length 1024