Crest Factor Reduction of Spectrogram Art Signals by Using an Audio Clipping Technique

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1. Introduction

Spectrogram art communications convey visual messages drawn on sound signals. This study attempts to reduce the crest factor of spectrogram art signals to improve their visibility. This paper describes some experimental results evaluating our proposed technique that employs an audio clipping technique.

2. Proposed technique

Spectrogram art communications may transmit visual messages by using speakers equipped in ordinary laptop computers. It realizes near field communications without advanced wireless radio devices.

The distance of spectrogram art communications depends on the power of audio signals. Therefore, the crest factor of spectrogram art signals should be reduced as much as possible to improve the efficiency of the communications. The crest factor is defined as the peak amplitude of a waveform divided by the RMS (root mean square) value [1].

Spectrogram art signals may be generated by filtering white noises with arbitrary mask patterns [2]. To reduce their crest factor, this study introduces an audio clipping technique, one of the approaches proposed for the crest factor reduction so far. However, this nonlinear process causes unnecessary frequency components decreasing the visibility of the spectrogram arts. Therefore, the proposed technique filters the resultant signals with the same mask pattern employed in the generation of the spectrogram art signals to reduce such defects. In addition, an audio compression technique is also employed to reduce further the crest factor after the above clipping process.

Figure 1 (a) shows the spectrogram art of a sound signal without the proposed technique. Its crest factor is 7.61. On the other hand, Figure 1 (b) shows the spectrogram art of a sound signals with the proposed technique. Its crest factor is 3.10. These spectrogram arts were obtained in a computer simulation where the amplitude range of their sound signals was set to be the same. It appears that the visibility of the spectrogram arts may potentially be improved by the proposed technique.

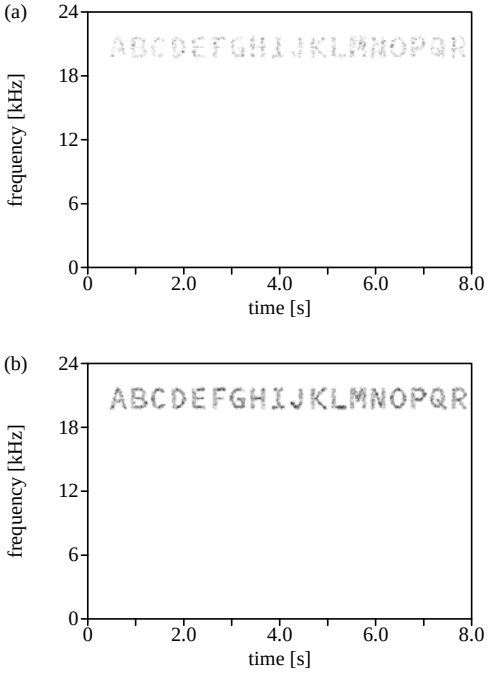

Fig. 1 Spectrogram arts obtained in a computer simulation. The crest factor is (a) 7.61, and (b) 3.10, respectively.

3. Conclusions

The proposed technique may potentially increase the distance of the communications. Further experiments will be performed to confirm how far the proposed technique emits spectrogram art signals in real situations.

References

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[2] N. Aoki, S. Anazawa, K. Ozeki, Y. Dobashi, K. Ikeda, and H. Yasuda, "Possibilities of Visual Communications Using Additive and Subtractive Spectrogram Arts," SISA2020.

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