Design of Communication System of Underwater Hybrid Voice Communication System

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INTRODUCTION

In the field of underwater acoustic communication, some underwater devices often operate voice communication and digital communication separately when communicating, and the existing analog modulated voice communication and digital coded voice communication cannot distinguish between digital communication and voice communication in time, resulting in data The transmission speed is slower and the voice quality is lower. In order to solve this problem, the design proposes the use of hybrid communication for information transmission, and designs a special communication protocol system.

METHODS

- The system adopts positive and negative hyperbolic frequency modulation in the synchronization head and synchronization tail, and adds a spread spectrum communication data header after the synchronization head.
- The system uses cyclic redundancy check (CRC) to distinguish between voice information and digital information and to synchronize them.
- Design of Frame Synchronization and Doppler Compensation
- Guard Interval
- Data Header
- Digital communications
- Single sideband voice communication
- Simulation Analysis
- We choose MATLAB software to generate $U_c = U\cos(\omega_c t)$ as the modulation signal, and its center frequency is $f_c = 12KHZ$. At the same time, this design selects a high-frequency sinusoidal signal as the carrier signal. The question about the choice of the center frequency of the carrier signal needs to be explained: the carrier frequency cannot be too large or too small, especially when applied to underwater sound. If the carrier frequency is too large, it is not conducive to propagation and will limit the propagation distance of the signal.

RESULTS

■The frequency spectrum and time-frequency diagram of the modulated signal ModulatedSignal.FFT-Spectrum are shown in Fig.1.

■ Then this signal is filtered by MATLAB. The frequency spectrum and time-frequency diagram of the filtered signal are shown in Fig.2.

■ The parameters of the water sink used in the test: length 2.5m, width 1.5m, and water depth 0.3m, as shown in Fig.3.

■ The communication process of the short-range transducer pool test is shown in Fig.4

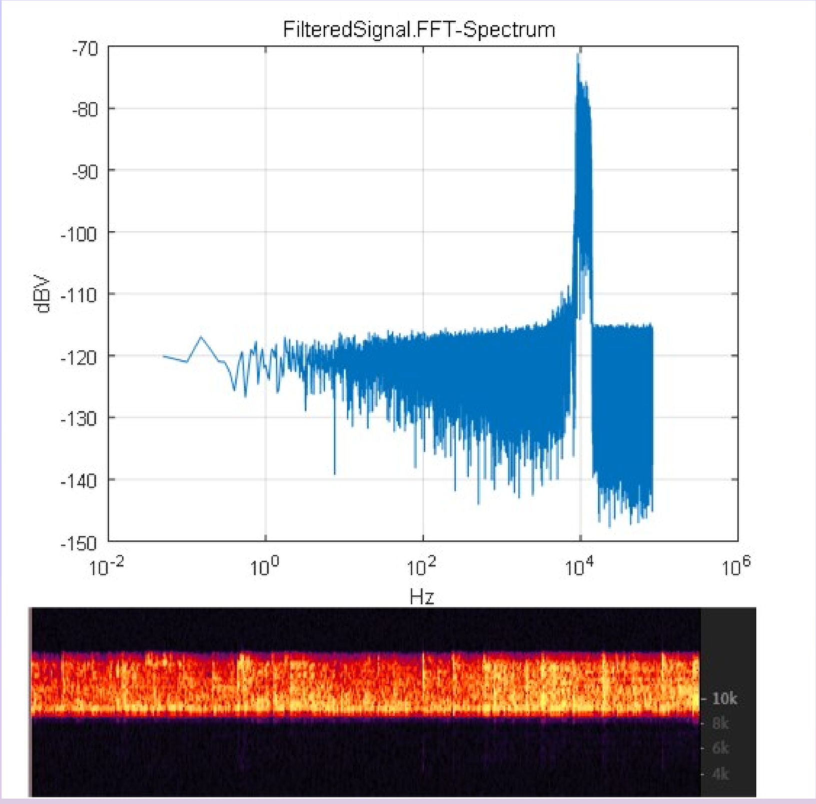

Fig.1

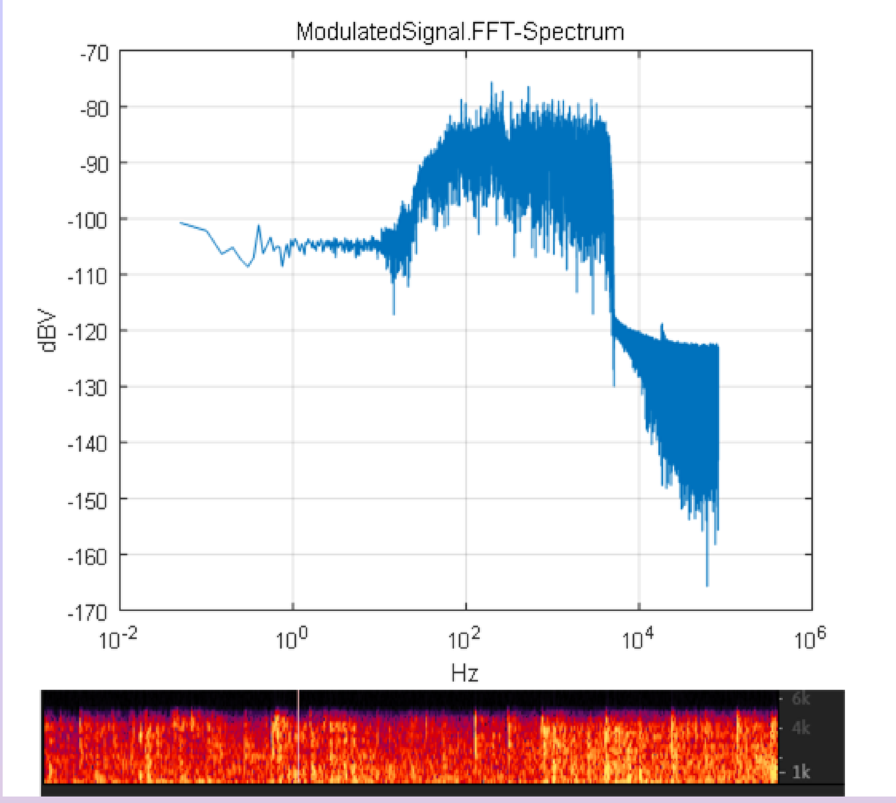

Fig.2

Fig.3

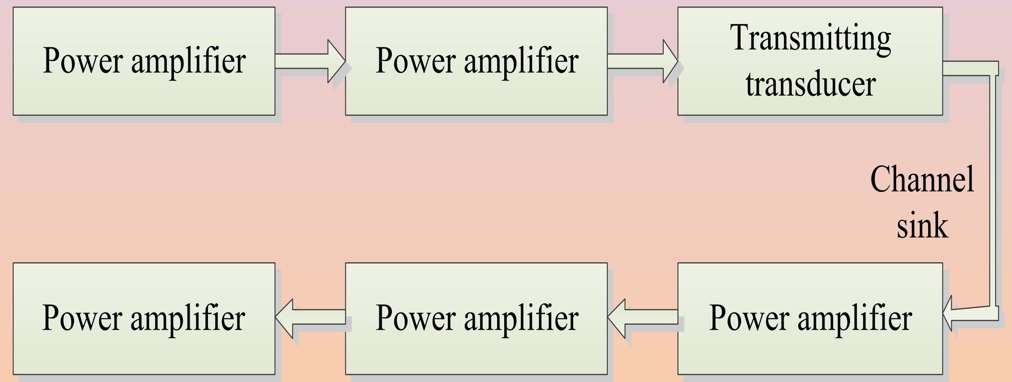

Fig.4

The test signal audio used in the experiment is a song, and the original signal waveform of the audio is shown in Fig.5.

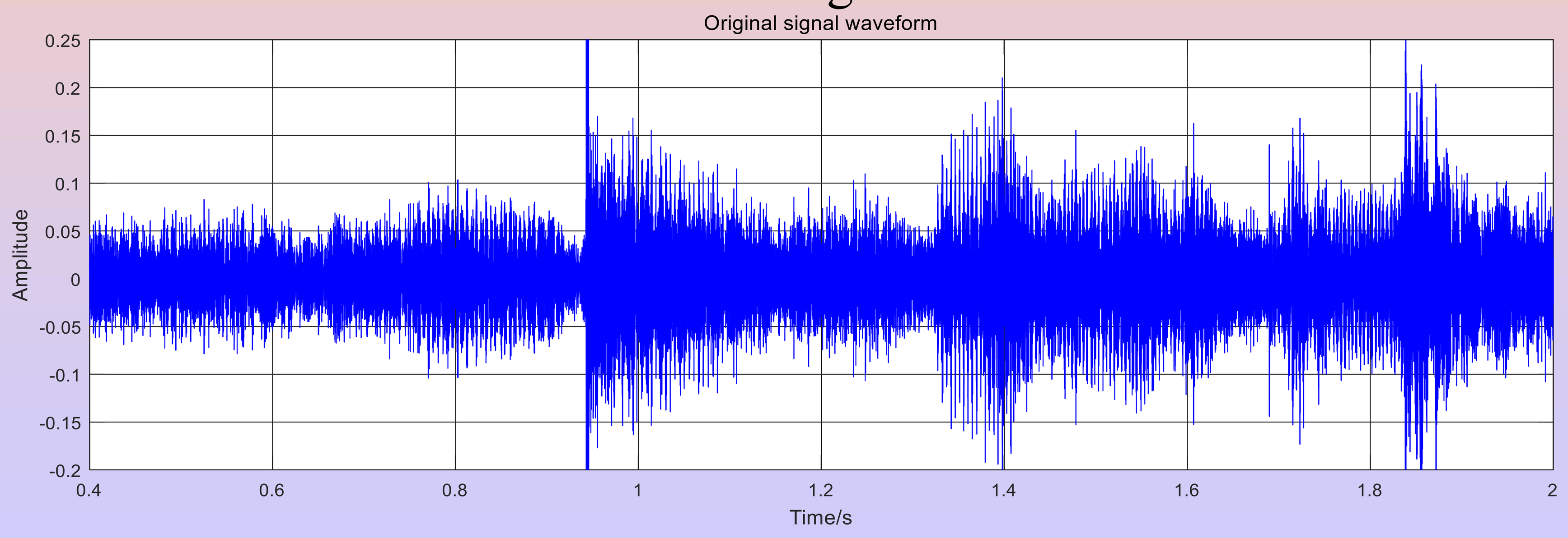

Fig.6

The receiving end gets the voice signal and restores the waveform as shown in Fig.6.

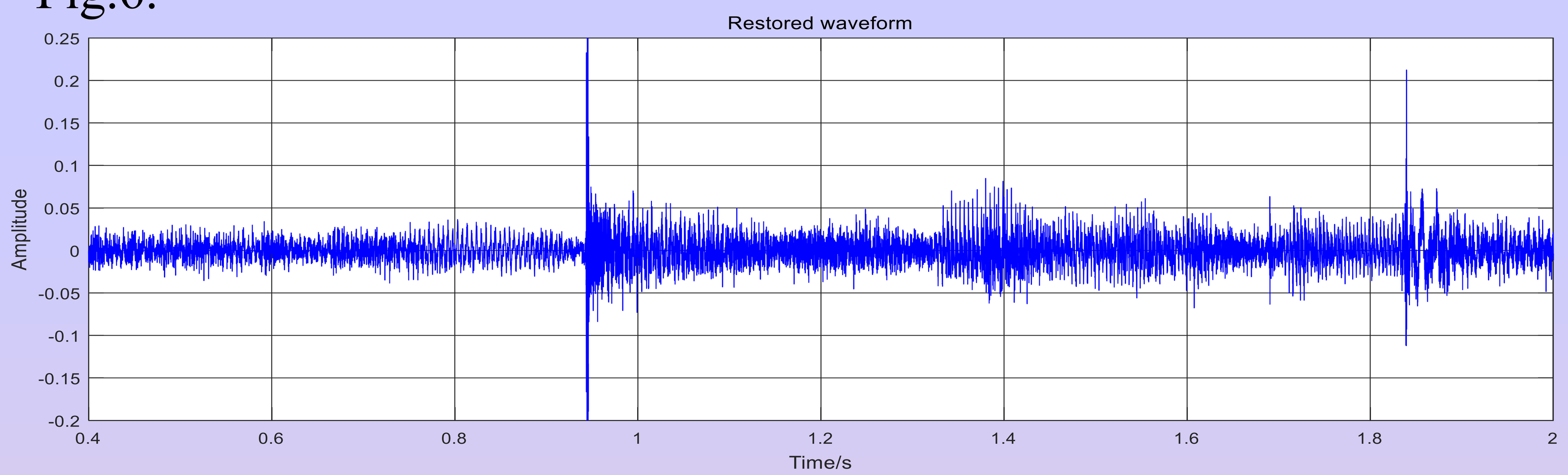

Fig.7

CONCLUSION

The simulation result shows that this design has got a very ideal voice effects and can improve the communication quality. Long-distance underwater communication can be carried out under a suitable Signal to Noise Ratio (SNR). Finally, the laboratory test in the sink proves that this design can effectively improve the communication quality of communication equipment and marine personnel.

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