

Acoustic Signal Processing of Underwater Target Tracking System

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Abstract: At present, with the continuous strengthening of China's comprehensive national strength, China's development and research on military weapons has also evolved from the introduction of foreign advanced technology to independent research and development. Among them, with the continuous development of underwater weapons, China's relevant underwater target tracking system is also becoming more and more perfect. The underwater target tracking system can effectively improve the testing capability of the underwater weapon shooting range, and improve our military capabilities. In order to effectively improve and enhance the target tracking ability of underwater weapons, this paper mainly analyzes the acoustic signal processing of underwater target tracking system, to effectively improve the ability of related signal processing systems, and further improve the underwater target tracking system.

1. Introduction

At present, with the continuous development of communication technology in our country, our underwater acoustic communication network has been effectively developed, and can be effectively applied to deep-sea development operations, deep-sea scientific research activities, and national defense military. Among them, the underwater target tracking system can effectively acquire relevant data in time through the underwater acoustic communication network, and exchange related information. In addition, the underwater target tracking system can effectively track and locate underwater targets, which is beneficial to information acquisition. The main content of underwater target tracking system is the related module design and processing^[1]. Therefore, this paper mainly analyzes the principle and related technology of the acoustic signal processing of underwater target tracking system, and expounds related processing modules, to effectively improve the capabilities of related signal processing systems and enhance the target tracking capability of underwater weapons.

2. Principle of Acoustic Signal Processing of Underwater Target Tracking System

2.1 Signal processing

Signal processing refers to the processing and coding of various electrical signals emitted from outside, and the required signal indicators are formed according to the intended purpose. Different signal processing methods have different views. For example, when processing analog signals, they are collectively called analog signal processing. In the process of processing digital signals, they are collectively called digital signal processing. The process of collecting and storing the acquired signals, and then extracting useful information which need to be extracted, transformed and analyzed, is called signal processing^[2].

2.2 Process of signal processing

In order to collect and utilize the transmitted signals, it is necessary to process the signals. For example, when the transmitted electric signal is weak, it needs to be amplified; when there is noise in the signal, it needs to filter the related signal, and when the signal is distorted, it needs to be restored. This process is called as the process of signal processing. Therefore, when tracking underwater objects for underwater operations, it is also necessary to process relevant underwater signals. Among

them, the most common method of underwater target tracking system is acoustic signal processing, which is a process that converts acoustic signal into digital signal.

2.3 Principle of acoustic signal processing of underwater target tracking system

The principle of acoustic signal processing in underwater target tracking system is mainly to use underwater sound waves to detect underwater targets, and locate them by feedback of related signals according to sound speed, wavelength and echo. Among them, sonar is the most typical underwater communication electronic equipment. Sonar is a communication electronic device composed of a transmitter, a transducer, a receiver, a timer, and a central controller. The instrument converts an electrical signal into a sound signal through a transducer by transmitting a related electrical signal through a transducer, and transmits the signal into the water. When the relevant acoustic signal is transmitted in the water, the acoustic signals will be reflected back if various targets and obstacles are encountered, and the reflected sound waves will be received through the relevant receivers, and converted into an electrical signal by the converter. After processing, the characteristics of the target and obstacle are displayed on the display screen. At the same time, the distance of the related target can be determined effectively by putting the signal into the round trip time. According to the pitch of the sound wave, the nature of the related target and obstacle can be judged^[3].

3. Related Technology of the Acoustic Signal Processing of Underwater Target Tracking System

At present, echo sounder is the most commonly used instrument in acoustic signal processing technology of underwater target tracking system. And the working principle of the echo detector is basically the same as that of the sonar. It can effectively use the signal transmitter and transducer to transmit sound waves underwater, so that the sound waves can propagate along the relevant medium, and be reflected back by the target and obstacles. And the signal will be processed to further determine the type and quantity of the straight target. Nowadays, the common acoustic signal processing technology of underwater target tracking system includes echo sounder, sonar, and fish finder^[4].

4. Acoustic Signal Processing Module of Underwater Target Tracking System

4.1 Hardware device of the system

In the acoustic signal processing module of underwater target tracking system, the most important part is positioning system, which includes active positioning and passive positioning. Active positioning is mainly to meet the accuracy of engineering applications. Therefore, the frequency of active positioning cannot be less than 500 kHz in signal processing and design. However, the active positioning system needs to work in the same operation, and there will be delays when processing different signals. The main function of passive positioning is to receive signals from 100Hz to 2kHz, and the passive positioning does not need to be carried out at the same time, there will be no delay phenomenon. When designing the acoustic signal processing system of underwater target tracking system, the requirements of its hardware system mainly depend on the relevant modules^[5].

4.2 Main indicators of the system

In the acoustic signal processing module of the underwater target tracking system, the main indicators of the related system are set, which mainly include the input of analog signals. Generally speaking, the number of channels is set to three channels, and the amplitude of the signals is - 10 to 10v, and the frequency is from 00Hz to 500kHz. The communication interface is a universal interface, which is convenient for replacement and maintenance. At the same time, the output analog signal is the same as the input analog signal, and the display is a color screen with touch function. The computing power mainly includes the ability to perform real-time underwater positioning.

4.3 Design of signal processor

The signal processor needs to satisfy the task of estimating underwater target azimuth when it is designed. Therefore, when designing the signal processor, the first thing to consider is the computing power of the processor, and the computing speed and the power consumption of the processor has to be a certain requirement. At present, common signal processor systems include C series products produced by TI.

4.4 Signal converter

The signal converter mainly converts the acquired signal to present the shape, orientation, quantity, and the like of the detected object in the form of an image. Therefore, when designing the signal converter, it is necessary to select a device with a higher resolution and conversion rate to effectively meet the needs of underwater operations.

4.5 Memory

In the acoustic signal processing module of underwater target tracking system, there is a certain requirement for the storage function of the related system. The storage function must be an independent system to prevent the acquired information from being processed and stored separately in case of emergencies. When designing the memory, a system with better memory performance can be chosen. A good memory mainly includes a device for storing programs and data, a storage bit, a memory word, a memory unit, a memory bank, a memory cell address, and word addressing, byte addressing and addressing. When storing the acoustic signals of underwater signal tracking system, you can select a cache memory that can access instructions at high speed and access data faster, but it has the characteristics of small storage capacity. Therefore, a special engineer is needed to aggregate and save the relevant information^[6].

5. Summary

In summary, when designing the acoustic signal processing module of underwater target tracking system, the main design principle is to detect underwater target by underwater acoustic wave, and locate underwater target according to sound speed, wavelength and echo by the feedback of related signals. And the content to be designed includes the hardware device of the processing system, the design of related indicators, the design of the related signal processor, the signal converter and the memory, to process the related sound signals and improve the performance of the relevant processor.

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