Key Aspects of Digital Audio Technology in Broadcasting Engineering: Postprint

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Abstract

With the continuous development of science and technology, digital audio technology has also achieved significant advancement and has been widely applied in radio and television programs. The application of digital audio technology, characterized by its strong applicability, has substantially improved the operational efficiency of radio and television programs. This paper primarily investigates the key technical points of digital audio technology in broadcasting engineering.

Full Text

Preamble

Research on Key Points of Digital Audio Technology in Broadcasting Engineering

Abstract: With the continuous development of science and technology, digital audio technology has made significant progress and found extensive application in radio and television programs. Due to its strong applicability, digital audio technology has substantially improved the operational efficiency of broadcasting programs. This paper focuses on researching the key technical aspects of digital audio technology in broadcasting engineering.

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Currently, digital audio technology is widely applied in broadcasting engineering. This technology achieves audio signal improvement through digital processing methods. The quality of this technology significantly impacts the audio quality

of television programs, and therefore, the relevant standards for digital audio technology are clearly defined. The following sections explore the key aspects of digital audio technology.

1.1 Development Status

With the advent of the digital age, people' s demand for digital technology has gradually increased, driving its widespread application. For instance, in the field of radio and television, this technology has been broadly adopted, enhancing program sound quality to a certain extent. In recent years, with China' s rapid technological development, digital audio technology has also achieved corresponding progress, characterized by high sampling rates and high sampling precision, among other features. Consequently, high sound quality can be obtained, and this technology has become a commonly used technique in professional audio production, further advancing China' s broadcasting industry. Under the application of digital television, the development of this technology has attracted attention from all sectors of society. Today, China places increasing emphasis on the development of proprietary intellectual property technologies, making the establishment of digital audio standards a pressing priority. Through in-depth research, China' s multi-channel audio source coding technology has achieved breakthrough progress and has been widely applied in the broadcasting industry.

1.2 Technical Indicators

This technology has corresponding indicators that guide its selection and application based on specific requirements. The compression ratio describes digital sound compression efficiency as the ratio between pre-compression and post-compression audio file sizes. The sampling rate records how much data is needed for one second of sound through waveform sampling, with higher rates generally producing better sound quality. The bit rate serves as a reference for digital compression efficiency, recording the average number of bits required per second for audio data. Finally, the quantization level, typically measured in bits, describes how many bits of binary data represent sound waveform data and is crucial for determining digital audio quality. When applying this technology in the broadcasting and television industry, these technical indicators must be emphasized to meet program sound optimization requirements.

1.3 Application Principles

When applying digital audio technology, broadcasting operations must convert analog electrical signals into digital signals through analog-to-digital (A/D) conversion. This process involves three key stages: First, sampling extracts signal amplitude samples from the continuous electrical signal on the time axis, using discrete points to represent the continuous analog quantity. Second, quantization processes the discrete signal amplitudes after measurement, with results

primarily represented in binary form. Third, encoding transforms the signal into a complete digital signal.

1.4.1 Strong Anti-Interference Capability

Digital audio technology fully utilizes new source coding technology, resulting in a significant change in bit rate to approximately one-seventh of the original FM technology. This improvement enhances audio signal transmission rates while also improving audio quality [1]. Simultaneously, through appropriate modulation methods, digital audio technology solves the problem of signal fading caused by multipath propagation and addresses Doppler frequency shift issues, endowing this audio technology with strong anti-interference capabilities.

1.4.2 Low Transmission Power

During propagation, digital audio technology requires very low transmission power, generally below 1 kW. This achieves energy conservation goals and enables effective environmental protection. Meanwhile, digital audio broadcasting systems allow synchronous network operation, which improves spectrum utilization efficiency, facilitates multi-service broadcasting, enables multiple programs on a single channel, and enhances investment returns.

1.4.3 Support for Multiple Data Transmission Services

As a multimedia broadcasting system for information, digital audio broadcasting can be used not only for audio program transmission but also for various additional data transmission services, such as traffic information and stock market data. Furthermore, through the application of digital broadcast receivers, users can achieve mobile reception of various data transmissions.

2.1 Expansion of Audio Tracks

In the production process of radio and television programs, a crucial step is audio recording and processing. By effectively transmitting processed audio information and using radios to receive signals, broadcasting purposes can be achieved. In program production, the effective application of digital audio technology can expand audio tracks, improving program audio quality and facilitating broadcast signal reception [2]. Additionally, during program recording, the rational use of digital audio technology enables 64-track recording, allowing adjustment of recording tracks based on actual conditions. This prevents errors that could affect program quality.

2.2 Improved Information Storage

As an important digital technology, digital audio technology has been widely applied due to its numerous advantages. Compared with other audio technologies,

digital audio technology offers greater practicality. It can compensate for the deficiencies of traditional audio technologies and solve various practical problems, including resource sharing issues, information storage space limitations, and information resource collection challenges [3]. Applying this technology to computer data storage devices enables information sharing and effective storage of audio resources. For users, information retrieval becomes faster and more convenient, thereby improving the operational efficiency of broadcasting engineering.

2.3 Enhanced Precision in Audio Editing

In the process of audio editing, digital audio technology is commonly applied, enabling high-precision audio editing. Moreover, under the influence of waveform technology, unmodified portions can be simultaneously transmitted to the display. This improves editing precision. During audio information editing, editors need to input sound into the display, which facilitates the editing work.

2.4 Efficient Information Dissemination

Early broadcasting systems were primarily responsible for wireless information transmission. However, with the introduction of digital audio technology, integrated functionality combining compressed digital encoding and networking has been achieved. Among these functions, compressed digital encoding is particularly critical. It refers to the use of comprehensive audio signal autonomous reception functions under the premise of human hearing to achieve frequency adjustment of audio encoding. This prevents the phenomenon of human ears being unable to perceive certain low-frequency audio signals, thereby enhancing the efficiency of information dissemination.

3.1 Digital Mixing Console

In broadcasting engineering, the digital mixing console is a crucial component that significantly impacts program production quality. Therefore, when adjusting the digital mixing console, it is necessary to maintain its original performance to prevent crosstalk or noise phenomena during live television broadcasts, thereby improving program broadcast quality. Furthermore, the combination of digital audio technology with mixing consoles has created a new digital mixing console that greatly enriches console performance [4]. Additionally, it adds module switching functionality, making program production simpler and more personalized. Even in complex and variable environments, digital mixing consoles can adapt flexibly and leverage their inherent advantages.

3.2 Audio Embedding Technology

During radio and television program production, various problems can arise. However, traditional audio technologies struggle to remedy these issues. Once

programs exhibit minor differences, staff must remake them, consuming substantial human, material, and financial resources and hindering the further development of broadcasting engineering. Introducing audio embedding technology into broadcasting engineering can improve program quality. By using this technology to build digital audio workstations, on one hand, human and financial investment can be reduced, and on the other hand, program production quality can be ensured. In other words, embedding audio information within a specified range and then using this technology to achieve effective transmission of video information ensures audio-video synchronization, thereby enhancing program effectiveness. From the perspective of digital video components, auxiliary data methods can be used to insert audio data. To ensure synchronization between audio and video, audio cannot be processed separately. Additionally, applying audio embedding technology enables synchronous transmission of audio and video [5]. This also reduces system complexity, decreases equipment consumption, and ensures normal program broadcasting.

3.3 Digital Audio Technology in Post-Production

In the post-production of broadcasting engineering, digital audio technology is commonly applied. It can enhance production effects and further improve program production quality. The effective application of this technology facilitates pre-recording work for production staff. For example, in the field of radio and television, the application of Dante digital audio transmission technology can improve program production quality. This transmission technology features high precision and low application cost. Its widespread application is primarily determined by its low-latency characteristics. This technology achieves uncompressed digital audio signals and integrates the Zeroconf protocol and self-healing systems. Under the function of configuration server automatic interface devices, the Zeroconf protocol can achieve automatic network configuration without starting DNS or DHCP services, meeting various practical application requirements.

Conclusion

In summary, with China' s scientific and technological progress and development, digital audio technology has advanced accordingly. In China' s broadcasting engineering, digital audio technology has been widely applied, offering numerous advantages such as strong anti-interference capability and low transmission power, which have significantly improved program production quality and efficiency. In radio and television program production, applying this technology can expand audio tracks, improve information storage, and enhance audio editing precision. Therefore, digital audio technology has been effectively applied in digital mixing consoles, audio embedding technology, and other areas. This paper first analyzed the current status, fundamental principles, and main characteristics of digital audio technology, then explored its role in radio and television program production, and finally elaborated on its specific applications. The authors welcome feedback and corrections.

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Note: Figure translations are in progress. See original paper for figures.