Postprint: Applied Research on Digital Audio Technology in Radio and Television Engineering

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Abstract

In China, audio technology has a development history of nearly a century, while digital audio technology has evolved for over three decades to date. Consequently, digital studios have gradually been established in tandem with the advancement of digital audio technology, officially inaugurating the era of digital radio and television broadcasting in China. Compared with traditional broadcasting, digital radio and television have undergone optimization in both audio processing technology and the entire video playback process, markedly improving the audience' s audio-visual experience. Therefore, the effective application of digital audio technology in the field of radio and television broadcasting engineering has become a crucial component of contemporary broadcasting engineering; we must fully exploit its advantages to deliver superior experiences to audiences.

Full Text

Research on the Application of Digital Audio Technology in Radio and Television Engineering

Abstract

In China, audio technology has a history of nearly one hundred years, while digital audio technology has been developing for over three decades. Consequently, digital studios have been gradually established alongside the advancement of digital audio technology, officially ushering China into the era of digital radio and television. Compared with traditional broadcasting, digital radio and television have optimized both audio processing technology and the entire video playback process, significantly improving audience audiovisual experiences. Therefore, the effective application of digital audio technology in radio and television engineering has become a crucial component of contemporary broadcast engineering.

We must fully leverage its advantages to provide audiences with superior experiences.

Keywords: Digital audio technology; Radio and television; Engineering; Field; Application; Research

Introduction

Nowadays, with the development of digitalization and networking, radio and television engineering projects have emerged prominently. One of the primary challenges is how to effectively integrate broadcast engineering with digital technological means. As digital audio technology advances, the playback effects and quality of radio and television engineering have achieved qualitative leaps, making intensified research on digital audio technology highly significant.

1. Concept and Working Principles of Digital Audio Technology

Compared with traditional broadcasting, digital radio and television have optimized both audio processing technology and the entire video playback process, markedly improving audience audiovisual experiences. What exactly is digital audio technology? Simply put, it is the mutual conversion between analog and digital signals, accomplished through pulse-code modulation (PCM) involving sampling, quantization, and encoding. Digital audio equipment not only retains original analog signal information but also directly replaces traditional analog signal systems, thereby fully satisfying modern broadcasting demands for playback quality. Additionally, digital audio equipment can provide audiences with immersive experiences, greatly meeting viewer expectations. In terms of operational characteristics, digital audio technology in broadcast engineering primarily employs a point-to-multipoint working mode encompassing three aspects: high-speed signal wireless transmission technology, networking technology, and digital audio signal compression encoding technology.

2. Advantages of Digital Audio Technology

Against the backdrop of rapid high-tech development, the radio and television engineering field has achieved improvements in certain technical aspects. Currently, digital audio workstations for radio and television primarily consist of three components: digital broadcasting workstations, program management workstations, and digital recording workstations. The specific advantages can be categorized into four key features:

2.1 Multi-Track Digital Information Recording Digital audio workstations typically feature 64 tracks or more, enabling simultaneous recording of speech, music, and other audio information. Moreover, functions such as overdubbing and track relocation during recording remain applicable, greatly satisfying user demands for track flexibility.

2.2 Large Storage Capacity Since digital audio technology possesses the data storage capabilities of electronic computers, it can store substantial amounts of data information and audio content.

2.3 Strong Digital Signal Processing Capability Digital audio technology exhibits significantly stronger digital signal processing capabilities compared to traditional analog signal processing.

2.4 Sound Waveform Display Digital audio technology provides robust sound waveform display capabilities, particularly with precision digital editing, which greatly facilitates post-production editing work and enables more realistic waveform visualization, delivering enhanced experiences for audiences.

3. Significance of Applying Digital Audio Technology in Radio and Television

The application of digital audio technology in radio and television engineering can effectively improve digital television quality by expanding audio tracks, ensuring post-production editing accuracy, and facilitating storage. The significance of employing digital audio technology in broadcasting is manifested in three primary aspects:

3.1 Substantial Audio Track Expansion Digital audio technology represents the most fundamental operational method in radio and television engineering. Digital recording, audio broadcasting, and television program management impose stringent requirements on audio tracks. Digital audio technology addresses these demands through up to 64-track processing, simultaneously satisfying recording and playback requirements while enhancing broadcast audio quality.

3.2 Enhanced Broadcast Editing Accuracy Audio editing in digital audio technology is performed through high-resolution computers, enabling clear audio waveform display on screen. This greatly facilitates post-production editing, improves editing quality, and significantly reduces labor costs.

3.3 Improved Broadcast System Transmission Capability During practical operation, digital audio technology effectively integrates digital signal wireless transmission technology and digital television signal compression encoding technology. Combined with characteristics of human hearing, this greatly facilitates adjustment of broadcast audio bit rates. Furthermore, the information storage function, leveraging computer capabilities, allows users to save various audio and related data while enabling search and modification functions.

4.4 AES/EBU Interface Protocol

The AES/EBU (Audio Engineering Society/European Broadcasting Union) protocol has become the professional standard for digital audio technology. Professional broadcast equipment such as digital mixing consoles and DAT (Digital Audio Tape) devices support this protocol, which can transmit up to 100 meters in unbalanced mode and even greater distances in balanced mode.

As the name suggests, a mixing console performs audio mixing and processing. Digital mixing consoles improve upon traditional mixing functions, offering enhanced performance in distortion and noise reduction while adding features unavailable in conventional equipment, such as digital switching matrix functions. Digital audio technology also enables full utilization of different control surfaces without being affected by external environments or operational methods, thereby facilitating audio editing.

In broadcasting, the use of digital audio mixing consoles not only enhances television program effects but also effectively reduces broadcast distortion and crosstalk. Additionally, the switching functions of digital mixing consoles are widely applied in radio and television due to their immunity to environmental constraints and compact space requirements, greatly facilitating program production.

4.2 Application in Broadcast Audio Embedding

Digital audio embedding technology and digital component serial interface (SDI) technology are widely applied in television production systems, greatly facilitating program production and processing. In digital television program production, the most critical factors for program design and construction are digital audio embedding technology and digital component serial interfaces.

Since analog signals exhibit significant differences during input, their conversion to television signals for broadcast naturally produces substantial variations, generally including parallel and serial formats for retransmission after digital reception. Audio embedding technology inserts digital audio and auxiliary data into specific positions. When applied in radio and television engineering, digital audio embedding technology synchronizes with digital component video signals during insertion, and allows different sampling frequencies in the embedding process. This greatly satisfies broadcast development needs and audience requirements, substantially improving program quality.

4.3 Application in Broadcast Institutions

Signal interference represents a crucial factor affecting radio and television engineering quality. To ensure full utilization of digital audio technology advantages, signal interference issues must be resolved to improve program quality. The application of digital audio technology in broadcast engineering fully satisfies television program quality requirements and enhances overall program playback

quality by preserving original audio signal performance during playback, maintaining input/output signals in an analog state, and ensuring stable program operation. Additionally, radio and television can preprocess programs before broadcasting through digital audio technology, providing an additional quality guarantee that greatly prevents distortion and delivers superior auditory experiences for users.

Conclusion

With the rapid development and application of high-tech innovations, digital audio technology is becoming increasingly sophisticated. Its application in radio and television engineering represents not only an inevitable requirement of era development but also a crucial method for broadcast television to enhance quality. Digital audio technology effectively guarantees television program quality while compensating for certain deficiencies and shortcomings of traditional broadcasting. Nevertheless, numerous issues remain to be addressed in broadcast engineering under digital audio technology, requiring strengthened integration efforts and continuous research and development of new digital audio capabilities to promote industry development.

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