

A Preliminary Analysis of Rail Robot Applications in Large-Scale Variety Shows: Postprint

Authors: Zhu Hongjie, Zhao Lei

Date: 2023-10-08T00:00:00+00:00

Abstract

This study focuses on orbital robots, analyzing their fundamental composition and core technologies. Concurrently, by integrating specific case studies, it examines their practical applications in large-scale variety shows, aiming to enhance production standards and deliver higher-quality programming to audiences. It is hoped that this research will provide valuable references for relevant professionals.

Full Text

A Preliminary Analysis of the Application of Track Robots in Large-Scale Variety Shows

Zhu Hongjie¹, **Zhao Lei**²

(1. Huzhou News Media Center, Huzhou, Zhejiang 313000;

2. Large-Scale Events Department, Dragon TV, Shanghai 200125)

Abstract: This paper investigates track robots, analyzing their fundamental composition and core technologies. Through specific case studies, it examines their practical application in large-scale variety shows to enhance production quality and deliver superior programming for audiences. The study aims to provide valuable reference materials for industry professionals.

Keywords: Track Robots; Large-Scale Variety Shows; Monitors; Controllers; Information Technology

CLC Number: TN941

Document Code: A

Article ID: 1671-0134(2021)01-033-03

DOI: 10.19483/j.cnki.11-4653/n.2021.01.007

Citation Format: Zhu Hongjie, Zhao Lei. A Preliminary Analysis of the Application of Track Robots in Large-Scale Variety Shows[J]. China Media Technology, 2021(01): 33-35.

Against the backdrop of continuous information technology development, China's radio and television industry is experiencing ongoing growth, with audiences demanding increasingly higher standards for television programming. This necessitates that production personnel enhance both content quality and cinematographic techniques. Track robots offer unique advantages in photography, making them essential for delivering premium programming. Their ability to customize shooting parameters and adjust operational scope allows them to meet diverse production requirements. For instance, operators can configure focus, zoom, and elevation settings based on specific program needs. During filming, track robots can automatically adjust according to subjects and framing requirements, while also providing automatic data storage on SD cards for convenient access.[2]

1. Analysis of Basic Track Robot Structure

Track robots typically consist of a main unit, monitor, track system, and track dolly. The main unit and monitor enable real-time monitoring of robot signals and PGM signals, while the system's controllable touchscreen allows immediate adjustment of camera lens parameters for zoom and focus, providing robust data support for filming. The track and dolly facilitate rapid robot positioning, requiring designers to consider stage configurations when determining whether to install curved or straight tracks, enabling the system to accurately calculate acceleration times from standstill. Additionally, operators can control shooting angles by adjusting the jib's displacement and orientation.[1] Handles constitute another critical component, enabling lens zooming and focus control, while foot pedals manage the robot's movement direction.

2. Analysis of Core Track Robot Technologies

To deliver high-quality programming, operators must master lens control techniques and employ multi-camera, multi-angle shooting to effectively engage audiences. Track robots have thus become indispensable for ensuring program quality in large-scale variety shows, incorporating several key technologies:

2.1 Customizable Shooting Data

Beyond fixed-position capabilities, track robots allow operators to set parameters for focus, zoom, and elevation based on program requirements. During shooting, they can automatically adjust according to subjects and framing needs, with all data stored on SD cards for convenient retrieval and reuse.

2.2 Advanced Track Control System

Recent technological advances have matured track control systems, which can now record complete displacement from point A to B. Operators can activate

loop functions to enable automatic cyclic movement between points, enhancing shooting efficiency. When applied to opening, transition, and closing segments of large-scale variety shows, this technology ensures consistent framing and improves overall image quality.

2.3 Advanced Virtual Track System

Track robots enhance stage effects and deliver spectacular visual experiences through sophisticated virtual track signals. By employing remote positioning and 3D virtual scene implantation technologies, they ensure seamless integration between virtual and physical environments. Operators must maintain strict consistency between camera content and implanted 3D scenes to unify virtual and real settings, thereby strengthening visual impact.[3]

3. Importance of Track Robot Application in Large-Scale Variety Shows

3.1 Rich and Diverse Shooting Techniques

Compared to traditional cinematography, track robots offer more versatile techniques and methods. They can present programs more effectively while following performance movements for dynamic shooting, capturing every spectacular moment. A unique advantage is their ability to execute tilt shots, satisfying diverse angle requirements for large-scale productions.[4] Additionally, their exceptional responsiveness enables rapid camera operations, including position control and zoom adjustment, ensuring optimal framing.

3.2 Customizable DIY Devices

Different television galas have varying requirements, and track robots' DIY capabilities accommodate these diverse needs. Equipped with touchscreens, they allow convenient adjustment of zoom speed and smoothness. Furthermore, by leveraging big data and cloud computing, track robots can record individual camera operators' habits for instant recall during productions, significantly improving efficiency.

3.3 Trajectory Recording Capability

Most modern track robot systems feature automatic motion trajectory memory, recording all movements along the track. Operators simply control the robot during shooting, and the system automatically captures the motion data at 10ms intervals, storing cam displacement across seven different cam tables along with initial position information on SD cards. For repetitive shooting requirements, robots can automatically replicate movements according to preset parameters, achieving results comparable to motion control systems.[5]

3.4 Computer Remote Control Implementation

Traditional track robots required manual pushing, often causing uneven movement that affected filming quality. Modern systems feature computer-based remote control, enabling uniform motion and precise thrust regulation. By controlling thrust magnitude, operators can manage vibration frequency, elevating cinematography standards for large-scale productions.

3.5 Simple Installation

With only seven main components, track robots feature relatively simple structures that reduce installation difficulty while ensuring quality. Their strong adaptability accommodates various installation spaces, enhancing flexibility and efficiency. Additionally, they impose minimal stage environment requirements, significantly reducing visible equipment in shots and improving audience experience.

3.6 Excellent Virtual-Reality Integration Technology

Most track robots now feature advanced virtual-reality integration, enhancing both shooting effects and gala productions. They can effectively incorporate VIZRT, ORAD, and BRAINSTORM systems to strengthen virtual studio capabilities. This technology seamlessly merges real and virtual scenes, allowing audiences to smoothly traverse virtual environments during camera movements and delivering spectacular visual presentations.

4. Specific Application Methods in Large-Scale Variety Shows

As a relatively new cinematographic technology with numerous advantages, track robots have been widely adopted across various productions. The following analysis examines specific applications through case studies.

4.1 Application in Large-Scale Gala Events

Anhui TV's 20th Anniversary Gala successfully employed track robots for forward-tracking shots, particularly excelling in filming the Huangmei opera segment "Joy in the World." Extensive pre-production preparation included predetermined installation positions, angles, and movement trajectories, successfully merging virtual and physical scenes to significantly enhance production quality. Anhui TV now routinely uses K2 track robots in its gala productions. The K2 employs modular, highly integrated waterproof design with short-circuit protection, safeguarding systems for major event broadcasts and live news coverage. The K2 offers four height settings (551mm, 831mm, 1041mm, and 1341mm above ground), adjustable according to stage requirements. For two-stage and three-stage columns, adjusting jib height to 1535mm effectively expands camera elevation range to 800-1800mm, ensuring program quality. The gala's success

owed much to track robots, which elevated production standards and earned widespread audience acclaim.

4.2 Primary Applications in Program Recording

4.2.1 Equipment Selection To ensure track robots meet production requirements, personnel must thoroughly understand entire filming processes to select appropriate models. Statistics show K2 and ROSS Furio are the most widely used models. Track robots offer various track types that can be designed according to venue requirements, with different lengths and curvatures to satisfy high-quality filming demands. Their narrow track width allows installation in tight spaces, preserving stage aesthetics while reducing visible equipment. Additionally, they integrate seamlessly with virtual technologies, enabling operators to merge virtual and real scenes by adjusting camera parameters for spectacular visual effects.

4.2.2 Installation and Operation Both K2 and ROSS Furio systems use straight and curved tracks that can be installed directly in front of stages, occupying minimal space. Installation is simple and fast, typically requiring only one hour with adequate space. Their robust remote control enables precise bionic manipulation through virtual platforms. K2 robots support multi-axis simultaneous operation, allowing operators to control forward/backward/left/right movement while managing gimbal tilt and pan for continuous multi-axis coordination. This operational similarity to traditional cameras enables rapid deployment and ensures quality.

4.2.3 Virtual-Reality Integration Technology The K2 track robot used by Anhui TV features excellent virtual-reality integration, allowing pre-designed virtual scenes to be transmitted to the robot's virtual platform for seamless real-scene 对接. Operators manipulate the virtual platform first, then combine virtual and real elements in the viewfinder, merging both into a single frame to enhance efficiency. The process is simple, requiring only a computer. By installing sensors along the track, online monitoring data can calculate jib distance and angles for precise virtual-real alignment. Secure transmission gateways installed between departments enable safe file transfers through antivirus and detection protocols.

4.2.4 Specific Analysis of K2's PAN-BAR System Most K2 track robots use the PAN-BAR system for simple, efficient operation. Zoom and focus are controlled via dual handles with four customizable buttons adaptable to operator preferences. The bionic gimbal's tilt and pan synchronize with camera movement, while dual monitors display local and PGM signals. Touchscreens allow parameter adjustments, and jib installation significantly expands camera movement range. Operators can quickly adjust virtual scene positions through sliding menus, enhancing program value and meeting audience quality expectations.

In conclusion, applying track robots in large-scale galas not only enhances shooting techniques but also drives television innovation, significantly improving program quality and content. Industry professionals should prioritize track robot utilization to better present large-scale variety show content and deliver premium programming to audiences.

References:

- [1] Chen Jiayu. Research and Implementation of Control and Positioning Algorithms for Track Connection Detection Robots[D]. Shenzhen University, 2019.
- [2] Li Jianyu, Chen Chao. Application of Track Robots in Large-Scale Variety Shows[J]. Modern Television Technology, 2018(04): 127-129.
- [3] Jin Yu. Design of Track Camera Robot Control System[D]. Nanjing University of Science and Technology, 2018.
- [4] Hu Xi. Design and Implementation of Track Camera Robot Server System[D]. Nanjing University of Science and Technology, 2017.
- [5] Tang Hengbo. High Robustness Positioning Method for Track Robots[D]. Shanghai Jiao Tong University, 2019.

Author Biographies:

Zhu Hongjie (1977-), female, Shanghai, bachelor' s degree, intermediate editor, research focus: large-scale media event planning and marketing.

Zhao Lei (1973-), female, Wuxi, Jiangsu Province, bachelor' s degree, senior television director, research focus: large-scale events.

(Executive Editor: Zhang Xiaojing)

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

Source: ChinaXiv –Machine translation. Verify with original.