

Research on Color Control Technology in Color Management of Printing Process Based on Application Software

Gangneng Chen

Zhangzhou Institute of Science and Engineering, Zhangzhou City, Fujian Province, China

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Abstract: Color-Based Management Technology is One of the Core Supporting Technologies for the Development of Modern Printing Technology. According to Its Application and Development in Printing, It is Divided into Icc Color Management Technology, Color Management Technology Based on Color Appearance Model, and Color Management and Replication Technology Based on Spectrum. the Management and Control of Color Has Always Been the Most Important Issue. Color Management Can Provide a Consistent and High-Quality Color Regeneration Mechanism for Various Devices and Platforms. This Paper Introduces the Whole Process Color Management of Printing Based on Icc, and Points out That the Key of the Whole Process Color Management of Printing Lies in the Standardization and Standardization of Printing Production, the Digital Transmission of Color Information, and the Automatic Detection and Correction of Color in the Printing Process. Therefore, in the Use of Color Management Technology, We Should Correctly Understand It, and Control the Key Points of Color Management, So as to Achieve What We See is What We Get for the Printing Quality Assurance.

1. Introduction

Color Management Technology is a Technology That Converts an Image from a Color Space of a Source Device to a Color Space Supported by a Target Device. Its Purpose is to Provide a Color Reproduction Mechanism That is Consistent Across Peripherals and Operating Platforms, and Further Realize Real-Time Color Transmission and Reproduction Across Media [1]. as a Very Key Technology in Digital Printing Process, Digital Proofing Technology Plays an Increasingly Important Role in Promoting the Application of Digital Printing Process and Satisfying the Increasingly Personalized Production Needs of Users [2]. Color Management System Has Experienced Two Stages of Development. among Them, the Traditional Color Management Based on Color Control Started from the Color Electronic Prepress System in the 1970s and 1980s, Which Can Realize the Functions of Graphic Editing, Single Page Typesetting and Color Control, But Each Prepress System of Traditional Color Management Cannot Be Compatible with Each Other. with the Development of Science and Technology, a Highly Automated System of Printing Inspection Technology is Gradually Taking Shape, Moving from the Original Traditional Inspection Technology to High-End Automation. on-Line Detection System of Printed Matter Based on Machine Vision is the Development Trend of Printed Matter Detection [3]. Full-Process Color Management Can Promote Printing Production, and At the Same Time, It Also Puts Forward Higher Requirements for Printing Production. for Example, the Entire Printing Production Process Should Be in a Stable State, and the Printing Process Should Be Digitalized, Standardized and Standardized, and Intelligent Color Control Technology Should Be Adopted. This Paper Introduces the Color Control Technology from the Basic Principle and Application of Color Management in Printing Process.

2. Color Management in Printing Process

2.1 Icc Color Management Principles

In the Printing Process, the Color Description Capabilities of Various Types of Equipment and Materials Used in Color Image Processing Vary Greatly, and the Transmission of Color Information between Them Will Cause Great Losses [4]. All Input and Output Devices in the Color Process Should Have Their Own Characteristic Description Files, Which Record Information Such as Color Gamut and Non-Linear Correction Parameters of the Device in the Device-Independent Color Space. the Basic Idea of Icc Color Management Technology is: Firstly, Select a Device-Independent Color Space, Then Characterize the Devices in the Whole Process, Establish a Device Characteristic File, Finally Establish a Certain Corresponding Relationship between Each Device Color Space and the Device-Independent Color Space, and Use the Color Conversion Engine to Realize Color Conversion. the Basic Flow of Icc Color Management Technology is Shown in Figure 1.

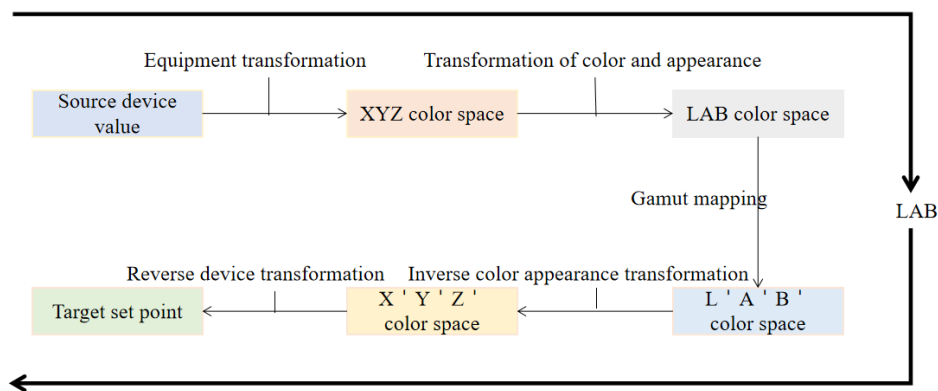


Fig.1 Icc Color Management Basic Process

In order to avoid these losses, ICC color management mode records their color characteristics and converts them to standard color space for processing, so that the transmission of color signals is not affected by the color characteristics and color gamut of various devices and materials. According to the specifications, the device's characteristic description file can accurately describe the device's color gamut and non-linear characteristics [5]. The color management component can perform accurate color conversion according to the device characteristic description file to realize what you see is what you get for color images. Therefore, the feature file contains data converted from the device color space to the space and data converted from the space to the device color space.

2.2 The Key of Color Control in the Whole Process of Color Management

The basic idea of color management in the whole printing process is that color management is applied to the whole printing process. Its core is that color information transmission is more efficient, accurate and intelligent. Color control is an important measure to ensure the effective implementation of color management. This structure conforms to the actual situation of current application. At present, there are many hardware manufacturers that manufacture image equipment. It is impossible for operating system and application developers to acquire the color characteristics of each image equipment one by one. As the equipment wears away, the color characteristics of the equipment also change constantly [6]. Samples are usually printed or printed by output equipment. It is required to take samples after stable operation of the equipment. It is also required that the number of samples should not only be a single sample, but also multiple samples should be taken so as to exclude individual special situations and take an average value, which can reduce errors. The quality inspection of printed matter is not only the basis for standardization of printing quality data, but also the necessary link for automatic control of subsequent printing. The key to color control lies in the standardization and standardization of printing production, the digital transmission of color information, and the automatic detection and correction of color during printing. Both the

operating system and specialized color management software provide corresponding CMM [7]. Because the color gamut of each device is different, it is impossible to have perfect color matching between each device. The color management module CMM selects the most ideal color to perform color gamut matching. Based on this, it realizes real-time collection, analysis, feedback and correction of color information in the printing process to achieve the purpose of color control.

3. Color Control Technology

3.1 Digitalization of Color Information

The color characteristics of each device in ICC color management are recorded, transferred and converted digitally. In the whole printing process, information digitalization was first implemented before printing. In order to enable Profile to accurately reflect the color characteristics of the equipment, a new one should be generated when the equipment characteristics change. Since it is difficult for the manufacturer to remotely control its color characteristics after the equipment comes out, users need to rely on third-party software to detect the equipment and generate the corresponding Profile. Some color measurements also require morphological changes of specific color substances, which is more important than how to measure color samples [8]. For example, to evaluate the color of ink, it is necessary to record and transfer the color information of the printed image of the color block sample according to the printing state of the ink through TIFF, PS, EPS, PDF and other files, and record the color characteristic information of the equipment in ICC files. It is mainly applied to occasions with high acquisition frequency. The LED lighting source has the characteristics of good directivity, high brightness and good lighting effect. The power supply mode is mainly DC stabilized power supply [9]. With this color characteristic file, the conversion relationship between the color space of the display and the standard color space can be known. When the fourth color, black, is used for color separation, the same image will appear clearer and the color will be more vivid, because black produces the effect of enhancing the appearance contour.

3.2 Digital Workflow

The basic idea of digital workflow is to integrate prepress, printing, postpress and management into a whole to realize digital recording and processing of graphic information, production control information and management information. When a color image is reproduced between different devices, the information provided by the devices will be used to convert the color data of the image from the source device color space to the destination device color space [10]. Since lighting and observation conditions have certain influence on the accuracy and measured results of spectral reflectance factor measurement, it is necessary to specify standard lighting and observation conditions in order to improve the measurement accuracy and unify the test methods. Color control information in color management can be transmitted and processed through digital workflow. The current digital workflow is mainly based on PDF and JDF standards, in which PDF standards are used to record graphic information and JDF standards are used to record management information. In order to check the degree to which the color displayed by the object under the light source to be tested matches the color displayed under the reference light source, the average color rendering index is used as a quantitative evaluation index. In actual production, the focus should be on the accurate correction of the displays used for scanning color separation and image processing, while the displays used for plate assembly and plate revision can be corrected generally. After fine correction, the display effect is very close to the proofing ink effect, thus the screen color has certain reference value.

3.3 Automatic Color Control in Printing Process

The color automatic control of printing process includes real-time collection, data analysis, feedback and correction of color data, which must be completed by the color automatic control system. This kind of system mainly includes: Close-Loop CMS, image control system, machine vision system, etc. CMM firstly uses the Profile of the display to convert the color data of the image

from RGB space to Lab space, and then converts the color data from Lab space to CMYK space according to the Profile of the printer. The printer outputs the image using the CMYK data obtained at this time. Different light sources have different effects on color vision. Therefore, to measure the color of an object, the measuring light source must first be determined. Close-loop color management system (Close-Loop CMS) is mostly on-line or on-line, that is, the color control is fully automated, and the whole process is not manual. The equipment installed with the closed cycle color management system will measure the color space of the output sheets in real time. In modern machine vision systems, CCD and CMOS are no longer clearly distinguished. With the development of CMOS (complementary metal oxide semiconductor) technology and the increase of market demand, CMOS image sensors have been developed rapidly. Generally speaking, the platform scanner uses CCD (Photoelectric Combiner), which makes it easier to obtain their own RGB data and can carry out color management. However, for the drum-type scanner, its appearance is far earlier than that of the color management system, and some drum-type scanners cannot carry out color management due to the limitation of technical conditions and market factors.

4. Research on Standardized Application of Color Management for Digital Printing Process Equipment Based on

4.1 Standardization of Color Management for Display Equipment

The determination of the white balance of the display can generally be expressed by the color temperature of the white area of the display or the tristimulus value coordinates of the white area. Color temperature is the color characteristic of light source expressed by numerical value. According to pixel distribution, brightness, color and other information; The image system performs various operations on these signals to extract the features of the target, and then controls the equipment actions on site according to the results. ICM supports Profile in ICC format and CMM of third parties. Microsoft recommends that hardware manufacturers provide a device Profile so that the operating system or users can color manage the device. The transmittance of an object is defined as the ratio of the amount of radiation transmitted by the object to the amount of radiation emitted by a person. The reference standard for the spectral transmittance of an object is air, because air is an ideal transmission body. Display characterization uses color scale to adjust screen color to simulate proofing or printing effect. Standard color proofs are printed by using color codes and outputting films. If the third color is added too much, it will darken the image and destroy the tone. For example, red mainly includes product color and yellow. If a certain amount of cyan is added, red will become dirty. Here red is the attention color and cyan is the gray component color. In addition, it is unpredictable to convert colors under a software with color management function, and the mode of color conversion also needs to be comprehensively considered according to factors such as the output purpose of the original document type.

4.2 Standardization of Color Management for Input Equipment

Before creating a scanner profile, you should first determine whether the scanner can carry out color management. If the scanner does not have the working mode of scanning RGB color mode, it cannot be color managed. The machine vision system has the advantages of fast detection speed and high accuracy. In color management, the machine vision system can be used to detect the color difference and color uniformity of printed matter, thus greatly improving the efficiency. For example, a user can adjust the color balance of an image by establishing an abstract Profile. The image will eventually produce a color balanced output value through the source Profile, abstract Profile and destination Profile. Similarly, CMM can use a composite Profile that combines source Profile, destination Profile and abstract Profile for color conversion. Figure 2. It is accomplished by the joint action of data and human vision, and mainly depends on the operator's experience. It is subjective and unstable. The other method is completed by means of standard manuscript and feature description file generation software, and the operation process is more scientific and accurate. Through calibration, it is determined that the color information of the same device has

consistency and repeatability in the process of acquisition and transmission at different times. The calibration process is to ensure color matching so that each device in the image system can color according to its corresponding color rendering mode.

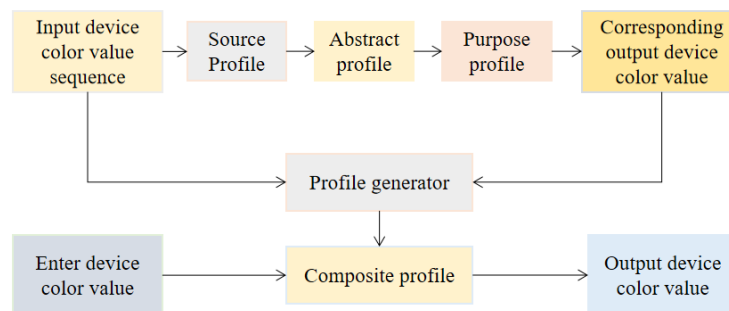


Fig.2 Cmm Uses Abstract Profile to Generate Composite Profile to Realize Color Conversion

4.3 Standardization of Color Management for Output Devices

Some papers contain fluorescent whitening agents, which can convert ultraviolet light into blue visible light, making the observer's eyes look whiter and brighter. Unlike the eyes of the observer, the spectrophotometer has no white point adaptation function and will not be affected by whitening agents. The real color conversion function is realized by CMM. CMM accesses Profile through functions provided by ICM, and then uses the color characteristic information provided by Profile to establish color conversion. For the output device, by measuring the chromaticity values output by different monochromatic colorants, it can be recognized whether accurate gray balance and ideal gradation can be achieved on the basis of ensuring the best color gamut. Make color conversion and matching more accurate. Therefore, most tool software also provides one or several proprietary CMYK color scales. Due to the instability of the output equipment, it is better to measure multiple color scales and calculate the average value of the measured values of each color scale when making the characteristic file for it. The color proofing process starts with printing CMYK as input data, color image data adjustment during the conversion from the printing color space (CMYK1) to the proofing color space (CMYK2), and the adjusted image data is then printed by the calibrated proofing machine. Stable printing parameters are closely related to the material environment and equipment in the whole printing process. Only through comprehensive quality control of all factors that can affect the color quality in the production process can color management be successfully realized.

5. Conclusion

Color management technology is one of the core supporting technologies for the development of modern printing technology. It is the key to realize cross-media publishing and high-fidelity printing. If our printing enterprises want not to lose their survival capital in the fierce market competition, it is very difficult to reach the predetermined goal simply by purchasing advanced equipment without good technical cooperation. Image pattern recognition, image matching technology and other related algorithms are used to process the printed image to improve the detection accuracy of the printed image. Based on the principle and implementation method of color management, the specific parameter settings and steps of each device in the whole digital printing process when implementing color management are deeply analyzed, and the detection and optimal selection methods of some parameters are summarized, which is conducive to standardizing the implementation of color management and obtaining better color reproduction effect. With the continuous development of color control technology and the deepening understanding of color management technology in the industry, the use effect of color management will be better and better, and greater benefits will be brought into play.

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