Research on Color Matching of Real Dot Proofing

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Abstract

This paper takes proofing paper and ink bought from market as the research object. Based on the principle that dot is the smallest unit of printing, we get a method to calulate the dot compensation of real dot proofing. By calling the dot compensation curve, make sure the dot size of real dot proofing is consistent with that of printing sample, finally we can achieve the color matching between the real dot proofing and printing product. The result of experiment validates the correctness and feasibility of this dot compensation method.

Introduction

After the digital proofing is gradually accepted by the people in the industry, real dot proofing technology has been receiving increasing attention nowadays. The real dot proofing uses 1-bit-tiff format which include all the information about printing surface, and it is not only the color matching but also the expression of characteristics of printing dots. In the real dot proofing, we can see some printing problems beforehand, such as moire and colortrapping [1]. Therefore, it is a digital proofing which most faithful to final printing effects. However, the practical application shows that the real dot proofing using 1-bit-tiff format has a larger color difference compared with printing product than the traditional proofing using PS format [2]. This creates the contradiction between real dot proofing and larger color difference. For this reason, we need to solve how to reduce the color difference between real dot proofing and printing sample, and make it can really foresee the problems in printing process.

Experiment

Materials

Easicolor 517 digital proofing paper, Epson Ultra Chrome K3 ink.

Equipments

X-Rite 530 Spectrodensitometer, X-Rite EyeOne Spectrophotometer, EFI digital proofing software, Epson Stylus Pro 7880 digital printer.

Methods

Printing information is shown by dots [3], so if the proofing and printing dot percentages are identical with each other, it can get a good matching. Based on this guideline, we need some dot compensation to real dot proofing to make the proofing dot percentages in keep with printing's. The compensation principle is as follows.

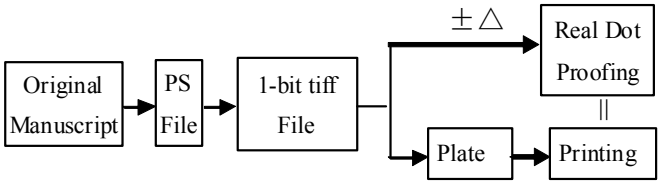

Figure 1. Proofing and Printing process

From Figure 1 shows that the digital proofing and printing use the same 1-bit tiff file to output [4], so the difference between proofing and printing is generated in the output process. Many reasons can account for this, such as the different paper and ink. But whatever the reason, we just have to eliminate the difference, the proofing and printing can achieve consistently.

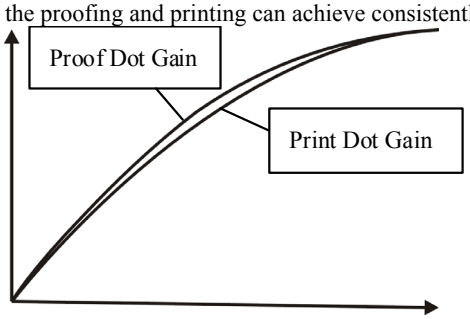

Figure 2. *The sketch map of dot gain*

As seen in Figure 2, we get the following equation to calculate the proofing compensation value A.

Proof Dot Area + A = Print Dot Area + Ideal Dot Area,

A= Ideal Dot %－(Proof Dot %－Print Dot %)

= Ideal Dot %－ △% (1)

Loading the curve of compensation value A to the software EFI, then we can correct the real dot proofing to get a better matching to printing.

The experiment is divided into following parts.

1. Print digital proofing samples with PS file and 1-bit tiff file respectively, then compare the dot percentages and average color difference between the two proofing samples and printing's;

2. According to the equation (1) to calculate the dot compensation of real dot proofing, then call the compensation curve to print the digital proofing sample with 1-bit tiff file, and also compare the dot percentages and average color difference at last.

Results and Discussion

Comparing the PS and 1-bit tiff file proofing with printing sample

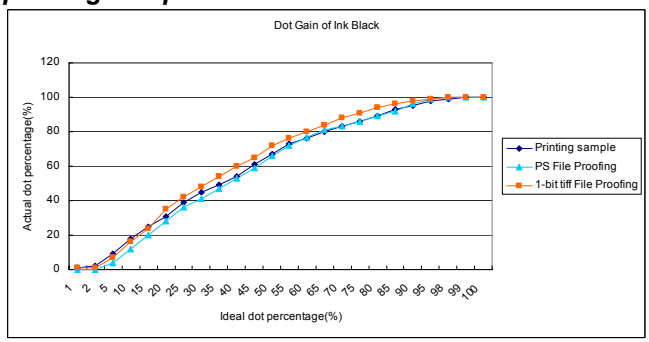

Figure 3. *Dot gain of ink black*

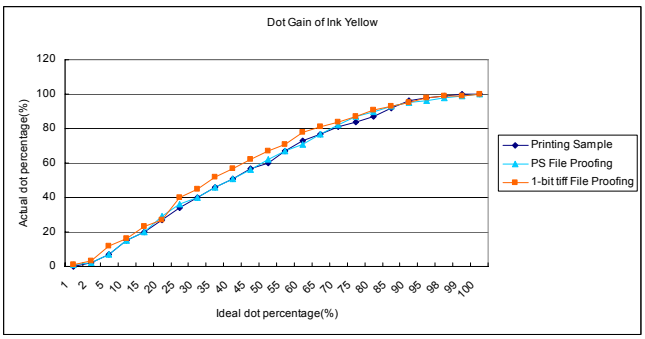

Figure 4. *Dot gain of ink yellow*

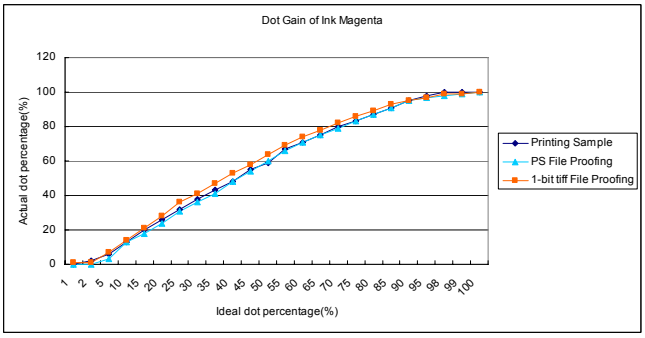

Figure 5 Dot gain of ink magenta

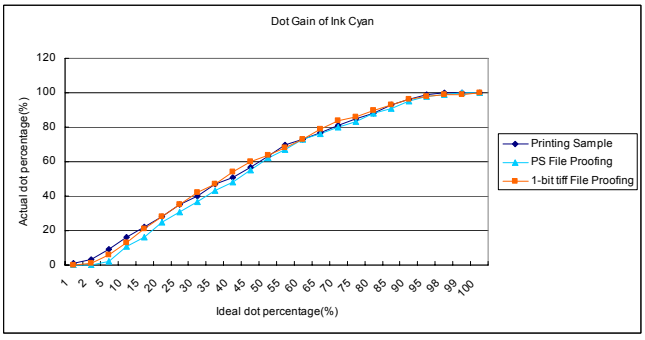

Figure 6. *Dot gain of ink cyan*

The dot gain curve of each ink are shown in Figure 3 to Figure 6. The results show that the curves of PS file proofing notch the printing sample ones very well. But the curves of 1-bit tiff file proofing are close to printing ones only in high key and shadow area, and the dot gain in middle tone is larger than printing sample. Based on this situation, we get the average color difference between PS file proofing and printing is $\Delta E=1.4$, while 1-bit tiff file proofing and printing is $\Delta E=3.2$. Therefore, the real dot proofing using 1-bit tiff format can not match well to printing sample without any compensation.

Comparing the compensated 1-bit tiff file proofing with printing sample

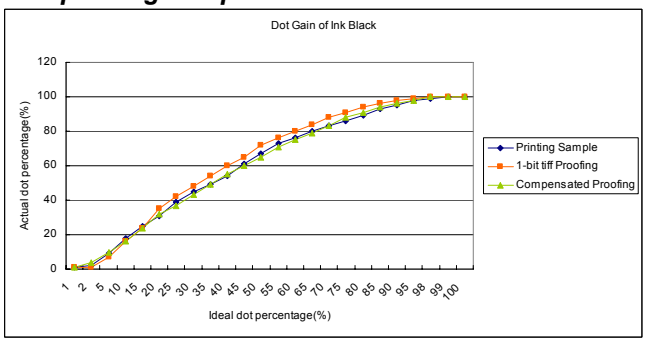

Figure 7. *Comparing the compensated proofing with printing in black*

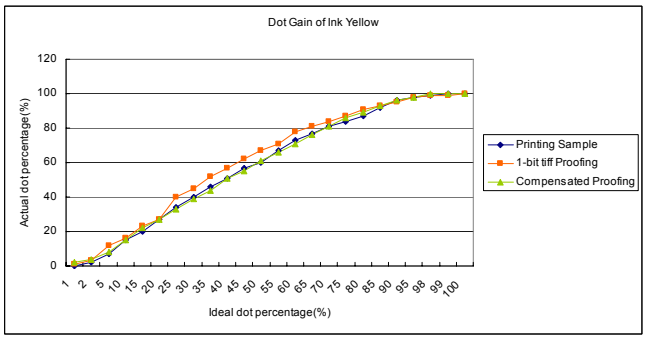

Figure 8. *Comparing the compensated proofing with printing in yellow*

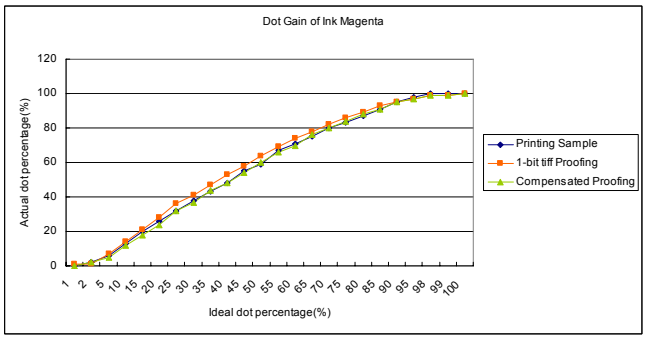

Figure 9. *Comparing the compensated proofing with printing in magenta*

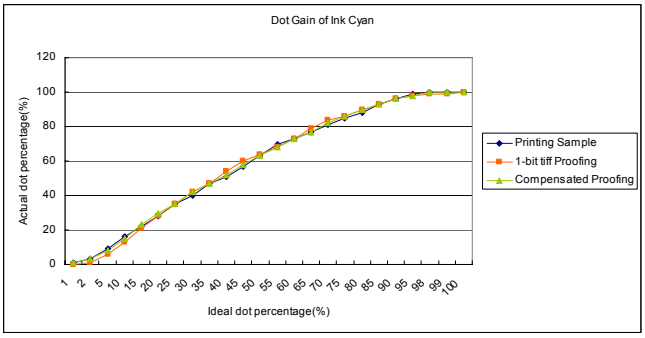

Figure 10. *Comparing the compensated proofing with printing in cyan*

The role of the dot compensation is reflected in Figure 7 to Figure 10. The results show that the curves of compensated 1-bit tiff file proofing are much closer to printing ones than the proofing without dot compensation. This suggests that the dot compensation has played a role. Then we print the ECI 2002 color target in the compensated situation, and get the average color difference between the 1-bit tiff file proofing and printing is $\Delta E=2.4$. This shows that when the dot gain curve of proofing is consistent with printing's, the color difference between them will also reduce. At the same time, it also proves the correctness of the dot compensation principle and the equation to calculate the dot compensation value.

Conclusions

According to the results mentioned above, we know that the real dot proofing using 1-bit-tiff format has a larger color difference compared with printing sample than the traditional proofing using PS format. The compensated real dot proofing really has a better match with printing, and the color difference is also smaller than the no compensation one. And at the meanwhile, it proves the correctness of the compensation method. In the practical application process, we can make compensation more than once until reach the satisfactory results.

References

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Author Biography

Qinwen Wang received her BE in Printing from Beijing Institute of Graphic Communication (2004) and her Master of Engineering in printing from Wuhan University (2006). Since then she has worked in South China University of Technology. Her work has focused on the development of digital workflow and color management issues. She is a doctoral student in printing engineering now.