Weft-backed Woven Structures for Enhanced Color Effect and Structure Integration of Colorful and Jacquard Fabrics

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OBJECTIVE

This study aims at developing modified weft-backed woven structures for enhancing color effect of colorful and jacquard fabrics based on single colored warp and multicolored weft yarns. Two types of weft-backed structures were designed for the yarn color mixing and the resultant fabric color performance was evaluated and compared for these two fabric structures.

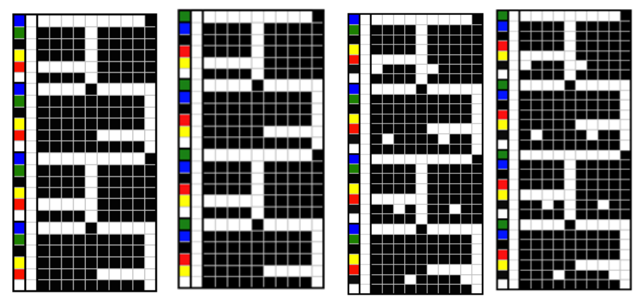
INTRODUCTION

Jacquard woven textiles often refer to colorful and figured woven fabrics. With multicolored warp and/or filling yarns, jacquard fabrics are made using jacquard looms. As a result, colorful, intricate patterns or figures are created all over the fabrics. With the intricate structures and unique features on pattern, color and texture, jacquard woven fabrics are nowadays widely used for fashion, home furnishings and decorations. In the design of colorful and jacquard woven fabrics, weave design and yarn color design are two important factors affecting the color and figure effects of the resultant woven fabrics. A number of studies have been carried out to develop design methods as well as investigate the color and weave effects for jacquard fabrics. Osaki proposed a method for the development of high quality color reproduction on silk Jacquard textiles from digital color images [1-2]. Gabrijelcic et al. explored the possibility of color values corrections of woven fabrics by changing of constructional parameters [3]. Mathur et al. developed a geometric model combined with a color model to predict the color contribution of each precolored yarn in terms of color attributes of each area of a Jacquard pattern [4]. Chae et al. proposed the geometrical and colorimetrical modelings for single-layered colorful woven structures with improved accuracy in color prediction [5-6].

Multicolored warp and filling yarns are commonly used in the jacquard woven fabric production to obtain good color and figure effect of jacquard fabric. However, with the modern weaving looms, weft yarns in different colors are used easily in woven fabric production while the preparation of warp yarn is more demanding and complicated than that of the filling yarn. Therefore, if only single colored warp yarns are used, the design of weft yarn color as well as woven structure becomes the key issue for the jacquard fabric compared to that using both multicolored warp and filling yarns. In this study, we tried to develop modified weft-backed woven structures for enhancing color effect of colorful and jacquard fabrics based on single colored warp and multicolored weft yarns.

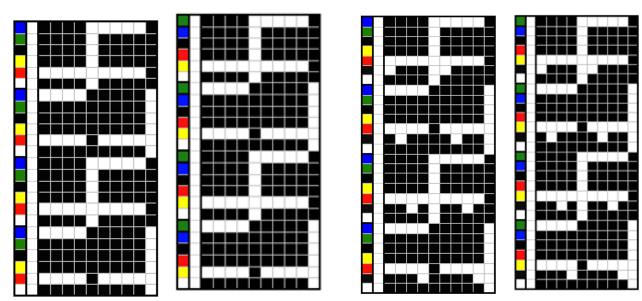
APPROACH

In this study, two types of weft-backed structures were designed for the yarn color mixing. One is a conventional weft-backed structure that consists of face layer and back layer, as shown in Fig. 1. Based on this structure, a modified weft-backed structure was proposed by adding a color regulating layer between face and back layers, as shown in Fig. 1.



Conventional structure   Modified structure

(a) Weave 1



Conventional structure   Modified structure

(b) Weave 2

Fig. 1. Weaves for conventional and modified structures.

Based on the coloring principle of woven fabric, weft yarns of 175 D polyester filament in six different colors of red, green, blue, yellow, black and white together with white warp yarn of 100 D polyester filament were used to create the desired colors and figures for the colorful and jacquard fabrics in this study.

Total fifty-six two-colors mixed woven fabric samples were produced by using the above-mentioned colored yarns and two weft-backed structures via a LX 3202 Staubl jacquard machine. The two color mixings are red-blue mixing and green-yellow mixing with different proportions of two colored yarns for face color, respectively. The fabric density is 47 ends/cm and 68 picks/cm and 58 picks/cm for conventional and modified weft-backed structures, respectively.

The color performance of the resultant colorful fabric samples was evaluated by using a X-rite 7000A spectrophotometer. The colorimetric data in terms of CIE

L^*, a^*, b^*, C^* and h^o values were calculated to investigate the effect of fabric structure on fabric color performance.

RESULTS AND DISCUSSION

Tables I and II show the fabric samples and their attributes by using conventional and modified weft-backed structures and red-blue mixing and green-yellow mixing modes. The results demonstrate that there is a significant color difference between two types of weft-backed fabrics. For red-blue color mixing mode, the modified weft-backed fabric has higher blueness but lower redness than that of the conventional fabric, and for green-yellow color mixing mode, the modified weft-backed fabric has lower greenness and yellowness than that of the conventional fabric. Combining the structure analysis and color evaluation, the modified weft-backed fabric presents deeper color performance, more even color appearance as well as more stable fabric structures compared to the conventional weft-backed fabric because the regulating layer of the modified structure that consists of black weft floats reduces the lightness of the face color, lessens the effect of color of back yarns and enhances the structure integration for the fabric.

Table I: Color attributes of fabrics by red-blue mixing.

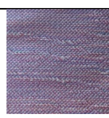
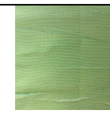
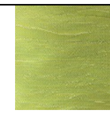
Color attributes	 Conventional structure	 Modified structure
L*	52.222	48.501
a*	7.012	3.464
b*	-8.875	-11.497
C*	11.310	12.008
h°	308.313	315.169
$\Delta E_{CMC\ (2:1)}$	**5.921**	
(a) Using weave 1		
	 Conventional structure	 Modified structure
L*	52.788	50.699
a*	17.586	16.987
b*	1.076	0.181
C*	17.619	16.988
h°	3.500	7.101
$\Delta E_{CMC\ (2:1)}$	**1.33**	
(b) Using weave 2		

Table II: Color attributes of fabrics by green-yellow mixing.

Color attributes	 Conventional structure	 Modified structure
L*	65.398	58.720
a*	-18.092	-17.728
b*	19.366	11.991
C*	26.502	21.402
h°	133.052	145.926
$\Delta E_{CMC\ (2:1)}$	**5.821**	
(a) Using weave 1		
	 Conventional structure	 Modified structure
L*	69.834	68.307
a*	-12.172	-10.797
b*	32.138	28.879
C*	34.366	30.831
h°	110.744	110.499
$\Delta E_{CMC\ (2:1)}$	**1.837**	
(b) Using weave 2		

CONCLUSION

In this study, based on the yarn color mixing principle and the features of weft-backed structure for face color mixing of the fabric, a modified weft-backed structure was developed by adding a color regulating layer between face and back layers and compared to the conventional structure. The experimental study demonstrates that such kind of innovative structure based on single colored warp and multicolored wefts is capable of expressing deeper color performance and creating more even color appearance and more stable fabric structure integration for the colorful and figured fabrics.

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