Prediction of Curling Distance of Dry-Relaxed Cotton Plain Knitted Fabrics

Part 1 : Theoretical Analysis of Moments on the Loop that Force the Fabric to Curl

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Abstract

Prediction of curling distance of dry-relaxed cotton plain knitted fabric has been realized by using multiple regression analysis. One set of the parameters that are used in the multiple regression analysis is the moments on the loop that force the fabric to curl. There have been several studies of the moments on the loop, but the models developed are too complex for practical use. Thus; in the present study, moments on the loop have been determined by means of Castigliano Theorem, which leads to a more usable model. The following results have been obtained:

(1) Simple formulas for the moments, M_y and M_x . These formulas depend on fabric and yarn parameters, such as course-wale spacing, yarn diameter and bending rigidity of yarn. M_y is the moment that affects the bending and side-curling behavior around the oy axis (Figure 5 a). M_x is the moment that affects the bending and top/bottom-curling behavior around the ox axis (Figure 5 a).

(2) Good agreement between M_y , M_x as presented and those proposed by Postle and Munden was observed [11] (M_y : 0.0367 g cm–0.04 g cm and M_x : 0.1896 g cm–0.175 g cm).

(3) Equations 20, 23, 25 and Table 1 and also previous studies [1, 2, 4, 5, 7, 8, 10, 11] show that the values of M_y and M_x increase as the tightness factor and bending rigidity of yarn increase. The values of moment around ox axis, M_y , are higher than those around oy axis, M_y .