Chapter - 6

Conclusions
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1) The knitting zone geometry derived from the machine parameters is useful for the modeling of 1x1 rib loop unit (SKC) during its formation in a flat bed double jersey machine. The equation of the ascending and descending sides of both the front and back bed stitch cams, as derived, determine the coordinates of the needle positions and help to calculate the length of yarn under the control between the two neighbouring needles. Five different types of loop arm configuration have been observed inside the knitting zone between the catching of yarn by the needle and reaching of the needle to the respective knitting point. The final configuration of the loop at the knitting point is considered to be divided into eight segments – five straight portions and the remaining three curvilinear segments in case of front bed and nine segments with six straight and three curvilinear for back bed. Equations were developed for calculating the theoretical length of each segment of the loop to ultimately obtain the theoretical length of the 1x1 rib loop unit (SKC) at the knitting point.

2) The phenomenon of occurrence of 'robbing back' has been observed and established in flat bed double jersey knitting. The average values are in the range of 5-18% obtained under limited combinations of knitting parameters.

3) Values of any particular knitting constant (Kc, Kw, Ks & Kr) for all the fabrics produced in both flat and circular bed double jersey machines are quite nearer, in fact there is no significant difference between the values at 95% confidence limit. These values match the findings of the previous researchers. Such values are in general much higher than the values of single jersey fabrics, which is obviously due to the difference in structure of the knitted loops in single jersey and double jersey fabrics respectively.

4) The value of Kc increases progressively from dry relaxed state to wet relaxed state and washing and ultimately reaches a stable maximum value at fully relaxed state where it is subjected to three consecutive ultrasonic treatments both in the case of flat and circular machines. This signifies that on subsequent relaxation process the fabric undergoes progressive
lengthwise shrinkage resulting in gradual decrease in the course spacing. There is no significant
difference in the values of $K_c$ after the second and third ultrasonic treatment, suggesting the fact
that after the third ultrasonic treatment the fabric reaches at a stable state or configuration and no
further relaxation or shrinkage takes place thereafter. It is observed that the fabric undergoes
variable widthwise shrinkage resulting in either small decrease or small increase in the wale
spacing at different relaxation stages. As a result the values of $K_w$ differ to some extent
depending upon state of relaxation but there is no significant difference in the constant values.
Comparing the differences between the mean $K_s$ values at different stages of relaxation it can be
inferred that there is a significant difference between dry relaxed (DR) and wet relaxed (WR)
stages but there is no significant difference between the $K_s$ values in the subsequent stages of
relaxation. There is some change in the loop shape factor ($K_r$) when the fabrics are subjected to
wet, wash and ultrasonic treatments. But after the first ultrasonic treatment the shape of the loop
becomes more or less constant and does not vary significantly after second or third treatments.
This signifies that the ultrasonic treatment produces full relaxation of the knitted fabrics and
results uniformity in loop shape factor.

5) The loop length of the fabrics produced in flat bed and circular bed knitting machines remains
almost unaltered after successive relaxation treatments. So the flat bed double jersey knitted
fabrics also behave similarly to that of circular single jersey and double jersey fabrics so far as
loop length is concerned.

6) In the study of the effect of loop length ($L$) on courses per inch ($c$) and wales (ribs) per inch
($w$) at different stages of relaxation, the best fitted linear regression equations between $1/c$ or $1/w$
and $L$ have been derived both in the case of flat and circular knitted fabrics. These equations
results very small standard error as compared to the regression equations if derived between cpi
or wpi and $1/L$. The intercepts of the regression equations in the dry relaxed state are visible and
are of negative sign and their magnitudes are considerably larger, which has a decreasing trend in
the subsequent stages of relaxation treatments and the values are least when the fabric samples
are subjected to ultrasonic treatments. It can only be explained that the intercepts are the results
of changes in processing variables during knitting such as take down load, knitting tensions, yarn
frictional characteristics etc governing the magnitude and sign of the intercepts and not due to the effects of yarn diameter.

7) In case of fabrics prepared in flat bed knitting, the lengthwise shrinkage is comparatively higher when the fabrics are subjected to ultrasonic treatment as compared to normal washing.

8) A significant effect of stitch cam setting is observed on the loop length and course spacing for flat bed knitted fabrics. With the increase in stitch cam setting the loop length increases resulting in an increase in course spacing. But the effect of front bed stitch cam setting is more prominent as compared to the setting of the back bed stitch cam setting. For any combination of stitch cam setting the course spacing is higher for fabrics prepared with finer yarn than for coarser one. There is no significant effect of yarn count on loop length of the knitted fabrics.

9) Width shrinkage increases with increase in take-down load (TDL) due to higher stretching of yarn during loop formation at higher TDL for flat bed knitted samples. It subsequently results higher relaxation. The effect of TDL on length shrinkage and aerial density of the knitted fabric samples does not follow any specific trend. As far as the effect of yarn count is concerned, for the sample prepared with comparatively finer yarn at higher TDL has shown some amount of length shrinkage. The loop length slightly reduces with increase in TDL.

10) Input yarn tension has got a significant effect on course spacing and loop length for circular bed knitted fabrics. With the increase in yarn tension there is a decreasing trend in course spacing and loop length. But the yarn tension does not have any significant influence on the wale spacing and fibre type.

11) Stitch cam setting has got a significant effect on course spacing and loop length for circular knitted fabric. With the increase in stitch cam setting there is increasing trend in course spacing and loop length. But the wale spacing and fibre type are not significantly influenced with the change in the stitch cam setting.