CHAPTER - 13

SUMMARY AND CONCLUSION

13.1 INTRODUCTION

Knitted fabrics, particularly the plain-knitted ones, suffer from a defect called as "spirality", and thus are being rejected by the garment industry. As far as this defect is concerned, it has been found that the yarn is playing a vital role in its contribution apart from fabric structure and machine configuration. For over seventy years, many researchers have been very active in finding out a solution to reduce the spirality. It is not uncommon to find a modern knitting mill equipped with latest knitting machines also turn out knitted fabrics with this defect.

This thesis attempts to provide a comprehensive study of spirality of single-jersey knitted fabrics aiming to reduce it, and to develop some techniques to solve the problem.

The rotor spun cotton yarns, despite its growing popularity, suffer from the disadvantage of lower tenacity. By introducing a roving in a Rotor spinning frame, it has been found that the yarns so produced not only differ from the regular ones in terms of yarn structure but also in bulk, mechanical and surface properties. These are designated in the current research work reported as "roving introduced rotor yarns" to distinguish them from the ubiquitous ones.

A number of methods have been tried to improve the tenacity of the rotor spun cotton yarns by resorting to hybrid spinning, sizing and strain...
hardening of rotor spun cotton yarns. Lord and Nicholas (1974) reported about 27 years ago that by detwisting, drawing and retwisting of rotor spun cotton yarns, their tenacity could be improved by more than 10%.

As regards the yarn characteristics of newly developed roving introduced rotor spun cotton yarns, it is noticed that the properties in terms of evenness and tenacity are superior compared to the ubiquitous rotor cotton yarns. Addition of 80s roving with the sliver has led to a marked improvement in the tenacity of the yarn.

These yarns possess higher tenacity, and low torque as seen from their properties; these should, no doubt, be brought into downstream knitted fabrics with a view to studying their potential. Thus this thesis aims to probe into the possibility of improving the quality of rotor spun yarns, and then to investigate in what aspects do these have an advantage over the regular rotor spun cotton yarns in terms of fabric properties.

The effects of fabric structure on the low stress mechanical properties have been investigated with a view to developing an understanding between structure and properties. Modifications in structures have been brought out by the use of miss and tuck stitches.

The thesis also addresses the effect of reducing twist in the yarn by a very small magnitude on the spirality and low stress mechanical properties of weft-knitted fabrics; the effects of aqueous treatment of yarns on the spirality have been examined with a view to finding out its potential.

The thesis also is concerned with a comprehensive study on the low stress mechanical properties of silk weft-knitted fabrics, an area where very little work has been done. Comparisons of a variety of weft-knitted fabrics with that of a silk obtained from China have been made to elicit the
most obvious disadvantages, if any, that exist in the other silk fabrics of Indian origin. A comprehensive literature review is presented in Chapter. Also, classification of weft-knitted fabrics by cluster analysis, a multivariate statistical technique, has been carried out.

13.2 SUMMARY

It has been found that the use of new roving introduced rotor spun yarns has led to a significant improvement in spirality of weft-knitted fabrics compared to the ubiquitous rotor spun cotton yarns obviously due to their low torque. In terms of the mechanical properties which are relevant to the handle of knitted fabrics, the ring spun yarn knitted ones outperformed the rotor spun yarns in terms of their handle. Fabrics knitted from roving introduced rotor spun cotton yarns show a deterioration in handle as compared to their counterparts obviously due to the high incidence of wrapper fibres.

Changes in knitted fabric structures have led to a marked difference in the low stress mechanical properties of weft-knitted fabrics. Use of tuck and miss stitches has led to a heavy and thicker fabrics; these subsequently affected the bending and shear parameters quite significantly. That the surface properties can be used as a measure to identify the structures in view of their bigger differences has been pointed out. By far it is the single jersey fabric which has exhibited a better handle.

It has been demonstrated that by removing a small quantity of twist as per the suggestion of Primentas (1995) significant improvements in spirality can be achieved. The larger the removal of twist, the smaller the spirality. In terms of fabric handle, fabrics knitted from the twist removed yarns have generally displayed a better handle.
The knitted fabrics were tested for their low stress mechanical properties in wale and course ways and also in bias direction in order to have a comprehensive idea of their behaviour. Another reason for doing this exercise is that in a garment, fabrics are cut in many directions and sewn together.

It was found that the low stress mechanical properties in bias direction display marked differences in that tensile, bending and surface properties show a decrease while shear properties exhibit an increase.

Experimental investigation of shrinkage of weft-knitted fabrics was conducted for the first time. Shrinkage was found to be similar in certain particular directions. Measurements of wicking, bagging, bursting, strength and handle force made on the fabrics show that they are chiefly affected by yarn characteristics, yarn structure, fabric structure and the types of stitches used.

The last phase of the study involved the application of cluster analysis for classifying the fabrics based on the objective measurement. It was found that the fabrics formed into four clusters which were characteristic of their structures. Thus this technique with its ability to classify, has shown to be a good technique for objective assessment of weft knitted fabrics.

13.3 RECOMMENDATIONS FOR FUTURE WORK

The major objectives of this research subject have been achieved. However, further work would be vital in order to develop the techniques still further discussed in this research. The following are some of the suggestions.
1. It would be interesting to develop melange yarns using the roving introduced rotor spun yarns and then to use these for knitting.

2. It is desirable to carry out a comprehensive study on fabric anisotropy of a variety of knitted fabrics to have a better understanding of their properties in all directions.

3. Techniques such as withdrawal force measurement should be made more accurate by sophisticated instrumentation.

4. It would perhaps be more desirable to vary the loop length in the case of silk and other knitted fabrics in order to study their geometrical and dimensional properties.

5. Attempts to study the relaxation treatments by a new technique other than the measurement of \( \frac{K_s}{K_w} \) and \( K_s \) should be made.

6. The modeling of shrinkage and fabric anisotropy is required to predict the mechanical properties.

7. Studies in which larger bending and shear strains are involved are required to have a better understanding of the fabric response. It may be also necessary to develop mathematical models for predicting the mechanical properties.