CHAPTER 15

SUMMARY AND CONCLUSIONS

15.1 INTRODUCTION

This thesis has dealt with various deformation modes of weft-knitted fabrics, mainly produced from cotton yarns on the Kawabata Evaluation System. Although the investigation of the structure of the knitted fabrics on their low stress mechanical properties has been the focus of the main study, several interesting features of knitted fabrics have also been recognised through this study. It is believed that such a comprehensive investigation could furnish a basis for predicting fabric complex deformation, understanding fabric mechanical behaviour and help lead to a more technological approach for the construction of knitted fabrics whose specifications are known.

In the other chapters, attempts have been made to characterise the geometry of knitted fabrics, model the various mechanical stress-strain curves of knitted fabrics, and examine the relationships of mechanical behaviour end geometrical properties. The summaries, in fact have already been provided separately in the corresponding chapters.

This chapter gives a brief and generalised account of the main findings and conclusions of the analyses in the aspects of fabric geometry mechanics and their relationships, and suggestions for further investigation.
15.2 CONCLUSIONS

In order to avoid including numerous initial assumptions which usually represent great simplification and are liable to introduce large errors in the analysis of fabric mechanical properties, the present study has begun with testing of knitted fabrics which differ in structure and yarn twist. The general findings can be concluded in the following.

15.3 MODELLING OF FABRIC PROPERTIES

Firstly and most importantly, the present work has placed emphasis on the charts obtained on the KES-system, which did not attract enough attention before, and a unifying thread has been provided for obtaining the fabric stress strain relationships which includes the deformation modes of tensile, bending, and compression. Young's modulus and other deformation stiffnesses have been obtained and their interrelationships have been studied. An in-depth study of compressional properties of weft-knitted plain fabrics has been undertaken, and it is demonstrated that the parameters suggested by Kawabata do not give a true picture of compression. Thus, this study, which perhaps is the first of this kind, is expected to provide a practical handy, convenient tool for the prediction of the stress strain relationship in garment-like systems, automation of clothing manufacturing, computer aided clothing design and others.

The tensile stress-strain curves under low stress conditions are modeled from the parameters obtained in the KES. The calculated results show excellent agreement with the experimental data.

Analysis of the hysteresis curves along with the characteristic variables of fabric bending and shear provide much information on a fabrics
response. It is suggested that the resistance to bending and shear within the fabric structure is always related with the frictional effect or hysteresis. Bending rigidity of the weft-knitted fabrics, it is shown can be predicted from the yarn bending and geometrical properties of fabrics.

The general conclusions are that scoured fabrics show that they are more flexible extensible and compressible compared to bleached fabrics. Elastic recovery values of scoured fabrics are higher than those of the bleached fabrics. Yarn twist and tightness factor of the knitted fabrics do not seem to affect the mechanical properties.

The sanding treatment has led to an increase in mass of the fabric, and are characterised by higher elongation and bending rigidity. Sanded fabrics are more compressible compared to control fabrics. Pique fabrics show that they have higher bending and shear rigidities and friction but lower compressibility.

The study on the effect of run-in ratio has demonstrated that it can be considered as a valuable tool for controlling the design and manufacture of pique fabrics. Run-in ratio affects most of the mechanical properties and thus can be considered as an important element in controlling fabric design of pique fabrics.

It has been shown that the discriminant analysis is capable of classifying the weft-knitted fabrics on the basis of their low stress mechanical properties. A total of 76 fabrics was subjected to this analysis, and it is quite interesting to note that they have formed into four groups on the basis of their mechanical properties.
15.4 SUGGESTIONS FOR FURTHER INVESTIGATION

There exist much work on the structural mechanics of weft-knitted fabrics which aims to predict fabric mechanical behaviour using yarn properties and fabric structure. It might be interesting to incorporate the proposed stress-strain models into the analysis of the existing mathematical equations, such as described in Hearle and Shanahan's paper (1978) to predict yarn physical properties or geometrical parameters using a reverse approach rather than the conventional one.

The study of the mechanical behaviour of knitted fabrics is largely limited to the relationships with fabric geometry and is not involved in any properties at the yarn level. Therefore, a more detailed analysis needs to be carried out in order to gain a better understanding of the interaction effects of yarn properties and fabric design especially the relationships with the constants in the models proposed in the present study that is it would be more ideal that the proposed models can have their structural - mechanic basis.