ABSTRACT

The thesis consists of three aspects: (1) Characterising knitted fabric structure; (2) Characterising mechanical behaviour of weft-knitted fabrics; (3) Investigation of relationships between their structure and properties. All these are done for a comprehensive understanding of the mechanisms of the measurements on the KES system, of various deformation modes such as tensile, bending, shear surface and compression of knitted fabrics.

It is believed that such a comprehensive investigation could furnish a basis for the prediction of fabric complex deformation understanding fabric mechanical behaviour and help lead to a more technological approach for constructing fabrics to give specifications and clothing production.

The study involves the production of 18 samples of single jersey fabrics and six pique fabrics the former produced from 30\(^{\circ}\) carded cotton and the latter from 34\(^{\circ}\) and 40\(^{\circ}\) combed cotton yarns. Besides these, three types of weft-knitted fabrics were subjected to sanding. Of the eighteen single jersey fabrics, nine were bleached and the other nine were scoured. The fabrics were tested for mechanical properties using Kawabata Evaluation System. It was found that scoured samples were more extensible, flexible, and more compressible. The run-in ratio in single jersey derivatives significantly affected the low stress mechanical properties. It was found that
peach finish had led to an increase in fabric mass, extensibility, bending, friction and compression. There was an overall improvement in the handle of sanded knitted fabrics.

It was found that some parameters such as bending and shear hysteresis, compression and tensile properties could be refined to have a better understanding of them.

Twist and tightness factor within the range studied were not found to affect the mechanical properties. The run-in ratio could be used as a parameter to control fabric structure and the mechanical properties of pique fabrics.

It was possible to classify the knitted fabric samples to four groups based on the low stress mechanical properties. Some new measures of studying compressional properties have been suggested to have a better understanding of them.

Modelling of tensile, bending and compression of weft-knitted fabrics has been done, and the predicted values agree closely with the experimental values.

It is believed that this study may provide guidelines to fabric design and quality control as well as understanding of fabric characteristics.