CHAPTER 1

INTRODUCTION

Silk fabrics form a unique category of textile materials, and mostly are manufactured by handlooms, unlike other woven fabrics which are produced by automatic and power looms. About 60-70% of the fabrics are loom finished fabric produced in the hand loom sector, and about 18% of this variety is produced in the power loom sectors. These types of fabrics are woven with the yarn which is subjected to twisting, degumming and dyeing before weaving. Other types of fabrics (12%) namely Crepe-de-chine, Georgette, and Chiffon etc., are invariably woven with twisted or untwisted raw silk yarns on the power loom. These grey fabrics are subjected to degumming, dyeing, stentering etc., to obtain the desirable characteristics on the surface of the fabric. The surface texture and handle of the fabric are dependent on the degree of twist imparted, denier and sett of the warp and weft yarns used in weaving, and finishing treatment given to these fabrics.

The production of silk yarns, the preparatory processes which are being adopted, and also finishing operations that are subjected to them are quite different from the conventional fabrics. Differences between silk yarns and those made from cotton and man-made fibres, or blends of these two normally can be attributed to differences in fibre properties, since similar yarn structures and processing methods are often employed.

Because silk yarns and fabrics have these special characteristics, the considerable volume of previous work concerning the structure and mechanical properties of yarns is not always strictly applicable to them. For example, the greater number of silk yarns are currently reeled on the
automatic reeling machine for which specific information on these subjects is rather slender.

The primary function of the clothing is to protect the human body from cold or hot environments and from injury to the skin caused by the mechanical contact with the external materials. Textile fabrics made from the natural fibres like cotton, flax, silk, wool etc., have been used by the mankind for a long time as the most suitable materials for clothing, and man made fibres are added to what are already available.

Although many textile fabrics are suitable as clothing materials, consumers continue to seek better or more comfortable fabrics. Now it is necessary to consider the importance of "better fitting to the human body" as a primary performance characteristic of clothing material. Textile producers and consumers have evaluated this kind of fabric performance by subjective means called handle, which means that fabric is touched and deformed by hand in order to be evaluated. In 1930 Peirce, suggested the correlation between the fabric handle and the bending stiffness of the fabrics, leading to the basic research on the fabric mechanical properties.

Fabric handle is a generic term for the tactile sensations associated with the fabrics, and it markedly influences consumer preferences of textile products. Fabrics are produced for various end use applications, the aesthetic requirements varying with the type of application. These requirements often relate to fabric stiffness. It is known that stiffness of the fabric itself is affected by an elastic component (the flexural rigidity) and non elastic component known as frictional couple. Both influence the drape of the fabric, the latter being partly dependent on the amount of shear.

The silk fabrics have traditionally been used for high class garments because of their beautiful and elegant appearance, soft, smooth and pleasing handle. These fabrics have a characteristic lustrous
appearance, and excellent draping quality. They are soft to touch, and have better crisper springy elastic property. This is mainly due to the extremely small shear force and hysteresis in the small strain. However, it has poor wrinkling property due to increase in the shear force, and shear strain at higher strains. The fullness and softness is mainly attributed to the crimp in the fibre, yarn, and to the effective gaps between the warp and weft at the intersecting point in the woven structure. This is due to the removal of sericin during the degumming of the grey silk fabrics to obtain the desired surface texture on the finished fabrics namely Soft silk, Crepe-de-chine, Georgette, and Chiffons etc. From the study, it is very clear that the various characteristic features are mainly attributed to the amount of twist in the yarns, fabric sett and finishing treatments given to the fabric. The amount and the degree of twist imparted play a dominant role in determining the handle of the silk fabrics, which is measured in terms of the fabric mechanical properties such as bending, shear, tensile, compression and surface roughness. From the survey of literature, it is evident that a systematic work has not been reported on the dominant role played by the twist in the silk yarn on the fabric properties.

The traditional method of evaluating silk fabrics is the subjective assessment of fabric handle by the experienced people who are familiar with different quality or handle attributes of these materials. The long history of the silk industry in China has resulted in several well defined styles or qualities of silk textile materials which can be readily identified by skilled experts working in the silk industry.

A survey of the literature on the mechanical properties of woven fabrics shows that a great deal of work has been done on the low stress mechanical properties of the woven fabrics in view of their importance. Mathematical models have been formulated to predict the low stress mechanical properties of the woven fabrics. In particular bending, shear, tensile, and compressional properties have been determined for cotton,
polyester, nylon and wool etc. except silk fabrics. In order to extend the research to silk textile materials, it is necessary to build up a sufficiently detailed and flexible data base of the low stress mechanical, surface and dimensional properties of the finished silk fabrics. Using this data base, it should be possible to ascertain whether it is possible to differentiate between and identify different known qualities of silk fabrics according to their objectively measured low stress mechanical and surface properties. It would then be possible to determine the relationship between these instrumentally measured properties and various silk fabric finishing processes such as degumming, bleaching, dyeing and drying on the quality attributes of the final fabric.

Modern technology has enabled the various mechanical properties of fabrics to be measured rapidly and accurately by means of various expert systems. In recent years a number of systems such as KESF (Kawabata, 1980) and FAST (Fabric Assurance by Simple Testing) developed by the CSIRO (1989) Division of Wool Technology, Australia, have been used for characterising the fabrics. These are currently being used in research not only to have an idea of the mechanical properties, but also to forecast their behaviour in garment manufacture. However, it is observed that these have been extensively used mainly to test polyester, cotton, polyester-wool and wool cotton blends, and data on silk are sparse.

It is possible that a data base of the finished silk fabric mechanical properties could be used to engineer new characteristics or attributes into finished silk fabrics, and also to provide a basis for the control of fabric making up operations during an apparel manufacture. As a result of the importance of handle of fabrics and the limited amount of work reported in the literature on this subject, the work to be described in this thesis was done to investigate the relationship existing between several methods for determining handle of silk fabrics.