A Study of the Graphical Representation of Plain-knitted Structures
Part I: Stitch Model for the Graphical Representation of Plain-knitted Structures
A. Demiroz and T. Dias

Department of Textiles, University of Manchester Institute of Science and Technology, Manchester 1, UK

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This study is based on the design of a software program to generate a 3-D graphical representation of plain-knitted structures on a computer screen by using the basic fabric parameters, i.e. the yarn diameter, the course-spacing, the wale-spacing, and the stitch length. The mathematical model is set up to establish the basic parameters of plain-knitted structures. The cubic-spline method is applied to describe the central axis of a stitch in a plain-knitted structure. The central axis of a stitch is defined by the control points. The positions of the control points are selected as points where the shape of a stitch is defined and where the geometrical properties of the structures are reflected. The results of this analysis are then compared with practical measurements obtained from an actual plain-knitted structure.

A Study of the Graphical Representation of Plain-knitted Structures
Part II: Experimental Studies and Computer Generation of Plain-knitted Structures
A. Demiroz and T. Dias

Department of Textiles, University of Manchester Institute of Science and Technology, Manchester 1, UK

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The theory of the mathematical model for the creation of plain-knitted structures on a computer screen was explained in the first part of this study. Based on this model, the experimental studies and pictures generated from the program are presented in this second part. The experimental study discussed was designed to verify the validity of the 3-D model of the stitch of plain-knitted structures. Experiments were basically concerned with the comparison of the experimental values of the upper-right distance with the theoretical value of the upper-right distance. Two kinds of experimental studies were carried out to verify the validity of the model. The two experimental studies are explained in this paper.
A General Theory for the Deformation Behaviour of Non-plain-weave Fabrics under Biaxial Loading

P. Potluri*, S.A. Ariadurai+, and I.L. Whyte!

*Department of Textiles, University of Manchester Institute of Science and Technology, Manchester 1, UK
+Department of Civil and Structural Engineering, University of Manchester Institute of Science and Technology, Manchester 1, UK
*Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka

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A theoretical model for woven fabrics is presented here to predict the load–strain behaviour of non-plain-weave fabrics under biaxial loading. Earlier published research is mainly based on plain weaves, with a few papers on 2/2 twills. The proposed theory makes use of the sawtooth geometry to deduce the force–deformation relationship for each possible type of interlacement between the warp and weft threads. The load–strain relationship for any weave can be predicted by assembling the force–deformation relations of each crossover point in the weave. A biaxial test rig was developed as an attachment to an Instron testing machine to validate the theoretical models. There is a reasonable agreement between the theoretical and experimental results, in spite of a number of simplifications made in the theoretical models.

The Effects of Feed Retardation on Lockstitch Sewing

W.R. Kennon* and S.G. Hayes

*Department of Textiles, University of Manchester Institute of Science and Technology, Manchester 1, UK
†Department of Clothing Design and Technology, Manchester Metropolitan University, Hollings Faculty, Manchester 14, UK

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The stitch-formation process of a lockstitch sewing machine is investigated with the aid of transducers that facilitate real-time monitoring of the sewing cycle. It is found that retardation of the fabric-feed timing by up to 25° results in a lowering of the tension at which the stitch is formed. This could have implications for the modification of seam slippage and the reduction of tension-induced puckering.

Characterisation of Textile Aerobic-activated Sludge Plant by Conductivity and pH Measurement

J. Binkley, J.A. Simpson, and P. McMahon

Bolton Environmental Technology Initiative, Faculty of Technology, Bolton Institute, Bolton, Lancs, UK

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In this preliminary study, the over-all ionic activity and pH in the supernatant of the sludge were measured after successive sludge washing with a range of aqueous buffers. As expected, considerable and varying degrees of ionic activity were observed at different pH values.

Samples of effluent and effluent plus sludge at different points throughout the aerobic-treatment process in an industrial plant were collected. Conductivity and pH measurements were recorded on the samples, and possible reasons for variations in both parameters are discussed.

A cost-effective method of heavy-metal removal from the sludge prior to disposal is considered.

**Fabric-sound Classification by Autoregressive Parameters**

E. Yi and G. Cho

*Department of Clothing and Textiles, Yonsei University, Seoul, Korea*

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In order to investigate the sound characteristics of fabrics, a wide range of woven fabrics was selected, and their rustling sounds were recorded. The sounds were analyzed in the forms of sound spectra through Fast Fourier Transform analysis. To evaluate the sound loudness of specimens, LPT (level pressure of total sound) values were calculated. Functions to which the autoregressive (AR) model was applied were used to describe the sound-spectra forms of specimens, and three AR parameters (ARC, ARF, and ARE) of the functions were obtained. Fabric sounds were classified into three clusters by cluster analysis of the parameters. Each of the clusters seemed to be characterized by the parameter ARC, considered to be related to sound loudness, and by the parameter ARE, affecting the over-all shape of the spectrum. To identify the mechanical properties affecting fabric-sound parameters, Kawabata’s KES-FB system was used for mechanical measurement. Tensile properties, shear properties, compressional energy, thickness, and weight showed significant differences among the clusters. Of these properties, shear properties seemed to be related to the ARC parameter concerned with sound loudness. Some of the tensile properties and compressional properties were thought to be related to the spectral shapes of fabrics. Finally, shear hysteresis and compressional energy were found to be significantly discriminant for three clusters.

**The Internal Structure of Sheath Fibre in DREF-3 Yarn**

S.M. Ishtiaque and D. Agrawal

*Department of Textile Technology, Indian Institute of Technology, Delhi, New Delhi, India*

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This paper is concerned with a study of the structure and twisting mechanism of sheath fibres in DREF-3 yarn, in which a tracer-fibre technique was used. The yarn was made from a polypropylene-fibre multifilament core and cotton staple-fibre sheath. An analysis of the twist and migration behaviour of the sheath is made to quantify the sheath structure. Process variables investigated are the spinning-drum speed, the yarn-delivery rate, and the surface structure of the core component. Other process variables, e.g. the suction pressure, yarn count, core–sheath ratio, and number of wrapper slivers, are kept constant. The effects on the sheath structure (quantified as the total twist, twist distribution, and migration behaviour) of certain process variables are discussed and possible causative factors identified. Conclusions arising from these in addition to visual observation of the sheath structure are used to explain the twisting mechanism of sheath fibres in DREF-3 yarn. An attempt is also made to explain the yarn properties for various process parameters on the basis of the sheath structure.
Fabric-bagging: Stress Distribution in Isotropic and Anisotropic Fabrics

X. Zhang, Y. Li, K.W. Yeung, M.H. Miao, and M. Yao

Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
*North-West Institute of Textile Science and Technology, Xi'an, P.R. China

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The internal stress distribution of bagged fabric is studied theoretically and experimentally to investigate the influence of the stress distributions on fabric-residual-bagging deformation. A model is derived by using membrane theory to analyse the stress distributions for isotropic fabrics under different boundary conditions, including consideration of different bagging heights and the friction between the fabric sample and the steel ball deforming the fabric. The results indicate that a non-uniform distribution of meridian stress and a non-continuous distribution of hoop stress, along with bagging height, are important factors that may influence residual-bagging deformation and may cause localised damage of the fabric.

To investigate the influence of fabric anisotropy on the bagging behaviour of a fabric, the stress distribution of an anisotropic fabric is studied on the basis of the measurements of tensile moduli in seven directions by using fabric strips and of the fabric strain calculated from the relation between the geometrical deformation and bagging height of a fabric. The analysis shows that a non-uniform stress distribution along the meridian direction and variation of the tensile angle $\theta$ may cause the difference in the yarn stresses between the warp and weft directions, resulting in different bagging shapes. Comparing predicted bagging forces with measured forces, it is found that the method is able to predict the trend of bagging force with some deviations.

Relative Contributions of Elasticity and Viscoelasticity of Fibres and Inter-fibre Friction in Bagging of Woven Wool Fabrics

X. Zhang*, Y. Li*, K.W. Yeung*, and M. Yao*

*Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
†North-West Institute of Textile Science and Technology, Xi'an, China

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This paper reports an investigation of the relative contributions of elasticity and viscoelasticity of fibres and inter-fibre friction to fabric-bagging behaviour of woven wool fabrics, by carrying out a series of experiments and applying a mathematical model to simulate fabric-bagging behaviour under the testing conditions. Through a large number of computation experiments, the relaxation time of the fibres, $\tau$, and three weighting coefficients ($k_1, k_2, k_3$) were determined for eight woven wool fabrics made from different fibres. It was found that the frictional weighting coefficient, $k_2$, and the relaxation time, $\tau$, are constant across all the fabrics, with $k_2 = 0.1$ and $\tau = 100$ seconds. The relative contributions of the elasticity and viscoelasticity of the fibres have a narrow distribution, with average values of $k_1 = 0.6$ and $k_2 = 0.3$. These results indicate that the three weighting coefficients and the fibre-relaxation time are relatively stable and insensitive to fabric structural differences. The consistent agreement between experimental results and the mathematical simulation over a range of fabrics shows that the model is quite reliable in simulating fabric-bagging behaviour.

Using the identified values of the parameters, we simulated the bagging behaviour of a new
set of wool fabrics. Reasonably good agreement between simulation and experimental measurement further confirmed that the three weighting coefficients and fibre-relaxation time are relatively stable and that the identified values can be used to simulate woven-wool-fabric-bagging behaviour with reasonable accuracy.

The Properties of Wool Fabric Prepared for Dyeing by Using Chemically Assisted Wet-setting Processes

A.G. De Boos*, G. Mazzucchetti¹, R. Demichelis¹, and P.G. Minazio⁺

*CSIRO, Wool Technology, Geelong, Victoria, Australia
¹CNR, Istituto di Ricerche e Sperimentazione Laniera 'O. Rivetti', Biella, Italy
⁺Woolmark Company, European Development Centre, Biella, Italy

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The level of permanent set imparted and the stability of the fabric to subsequent dyeing are increased by the use of reducing agents in setting operations prior to dyeing. However, their use has been criticized for damaging wool fibres. Work reported in this paper indicates that the effect of the setting agent on the final properties of the fabric is small. In pressure-decatizing, reductive setting agents had only a small effect on the amount of permanent set imparted and no significant effect on the properties of the final fabric.

Under industrial conditions, the level of fibre damage observed was much less than the level required to impair fabric quality dramatically.

Some Features of the Static and Dynamic Drape Behaviour of Polyester-fibre Shingosen Fabrics

M. Matsudaira and M. Yang

Faculty of Education, Kanazawa University, Kakuma-machi, Kanazawa City, Japan

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The static and dynamic drape behaviour of polyester-fibre shingosen fabrics was investigated precisely and analyzed by using the new mechanical parameters of the dynamic drapability of fabrics, such as the revolving drape-increase coefficient, $D_r$, and the revolving drape coefficient at 200 r/min, $D_{200}$. It is shown that the value of $D_r$ of Peach Face type was small and that of New Worsted type was large. The value of $D_{200}$ of New Worsted type was larger than that for other shingosen types. On the other hand, there was no difference between each group of shingosen fabrics in node numbers and conventional static drape coefficients. In the classification by production characteristics, yarn-processing-type fabrics showed larger values of $D_r$ and $D_{200}$ than fibre-production- and fabric-finishing-type fabrics. In the classification by fibre characteristics, contractile-fibre-type shingosen fabrics showed the smallest values of $D_r$ and $D_{200}$. These features of shingosen fabrics in static and dynamic drape behaviour became more distinct by means of discriminant analysis using the parameters of the revolving drape coefficients and also the conventional static drape coefficient and node number as variables.