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ИННОВАЦИОННЫЙ ЦИФРОВОЙ МЕТОД ТЕСТИРОВАНИЯ ТОЛЩИНЫ МАХРОВЫХ И ТРИКОТАЖНЫХ ТКАНЕЙ

INNOVATIVE DIGITAL METHOD OF TESTING THE THICKNESS OF VELVETS AND KNITTED FABRICS

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В работе предлагается новое цифровое устройство для тестирования толщины бархатной и трикотажной тканей в целом, утка и трехмерных петель. Принцип действия предложенного устройства основан на воздействии давлением на исследуемый материал. Устройство может быть полезным при исследовании свойств тканей в текстильной и легкой промышленности. Прототипом данного метода является разработка сотрудников университета г. Кафр-Эль-Шейх, Египет.

Ключевые слова: измерение толщины; цифровой метод; махровая ткань; трикотажная ткань.

A new digital device is proposed for testing the thickness of velvet and knitted fabrics in general, duck and three-dimensional loops. The principle of operation of the proposed device is based on the effect of pressure on the test material. The device can be useful in studying the properties of fabrics in the textile and light industries. The prototype of this method is the development of employees of the University of Kafr- El-Sheikh, Egypt.

Key words: thickness measurement; digital method; velvet; knitted fabric.

A prototype is model of apparatus for testing thickness of fabrics, is generally used to evaluate a new design to enhance precision by system analysts and users velvets and knitting clothes. In some design workflow models, creating a prototype is the step between the formalization and the evaluation of an idea. According that Fabrics are designed to fit different projected demands in order to be suitable for their end use of fabric constructor it is essential that the relationships between the constructional parameters of fabrics and their individual properties,[1]. We consider orthotropic structure properties of the yarn with three level of pile modules[2,3]. Objectives of prototype smart digital thickness test method for velvets and knitting fabrics measurement is invention to meet the requirements of knitting fabrics with other equivalent standards and customer specific written practice for training and certification in this method of non-destructive testing personnel. During this digital thickness test method for knitting fabrics measurement give us examination in general theory, Specification and practical high-frequency velvets and knitted fabric structure of geometrical surfaces.

Proof of principle prototype of smart digital thickness test method® for velvets and knitting clothes , this particular prototype serves to test the design without providing an exact visual match. Mechanical testing, product architecture, and materials may all effectively be tested using a proof of principle prototype, they are intended to provide the manufacturer with feedback regarding design in the science and practice of metrology, a prototype is a human-made object that is used as the standard of measurement of some physical quantity to base all measurement of that physical quantity. The only prototype remaining in current use is the international prototype digital thickness of velvets and knitting clothes, and computing means for calculating the property of the fabric from such measurement.

The process prototype is essentially a development of the parallel, integrated processes in which the technology of technological change is itself changing networking process. The warp-knitted patterned velvet fabrics are classified into single-bar velvet and doublebar velvet according to warp-knitting machines. Hence, plush yarn is assumed to be a translucent non-rigid cylinder composed of multi-layer textured layers. 2D color and transparency of pile yarns on each textured layer is computed by analyzing pile yarn's properties and underlaps length. Then texture mapping algorithm, relating to yarn's inclination, is researched for simulating 3D texture on pile yarns. Warp-knitted patterned velvet is mostly formed into a rectangle piece of fabric with evenly distributed loops. Number of loops knitted by same needle in one repeat equals to pattern length and number of wales equals to pattern width. Coordinate origin starts bottom right, the same location where driven device is equipped. Fig. 3(b,c): structure weft knitted fabrics(b) as normal at left, (c) with light pressure.

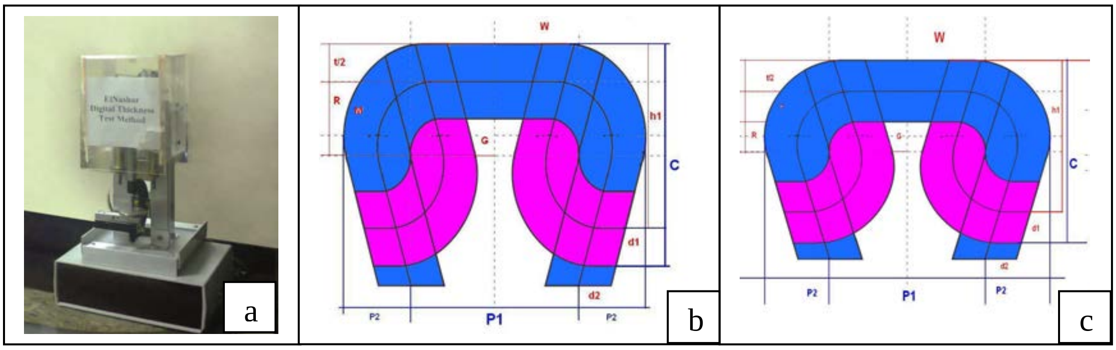

Figure 3: ElNashar Digital Thickness Test Method (a) and structure knitted fabrics(b,c).

Pressure and torsion of yarn cross-section

Digital thickness test method pressure is a stress and torsion of velvets and a single jersey fabric. It is a scalar of course-spacing, the wale-spacing given the thickness of single jersey fabric by the pressure on yarn cross-section of the force per unit area. With initial restricted contact area between them, it is the force per unit area exerted by the change of momentum of the molecules impinging on the surface. a change in the direction of motion requires a resultant force. The impact of a loop formation on a fabric surface is an elastic impact so that its pressure on yarn cross-section and and torsion energy are conserved. However, because its direction of motion course-spacing , wale-spacing changes on impact, a resultant torsion force must have been exerted by the fabric surface on a single jersey fabric. When we consider the forces acting on a torsion, for example, the lift force is proportional to the average pressure difference acting over the lower and upper surface of the wing. This pressure difference is caused by the fact that the average velocity over the upper surface of the fabric is somewhat greater than the average velocity over the lower surface . The pressure differences are usually small, but wings have a large surface area so that the total lift force can be very large. For low mach number flow, the pressure difference and the lift force are proportional to the difference in the dynamic pressures between the upper and lower surfaces.

The thickness (with the unit of mm) of each sample is tested using a thickness testing Instrument according to ASTM D1777-64.8. Each sample is also weighed on ElNashar-digital thickness-test method balance to determine its basis weight or areal density (g/m2). It was assumed that in the case of idealized (isotropic) test material of fabrics at the initial stages of extraction process, the outer contour of the specimen force and obtains the shape, which reminds the curve down rush. It was defined that in the case when the experimental and calculated number of fabrics density practically coincides for most of the materials, complex criterion is defined on the basis of polar diagram in which eight parameters are laid in a strict order. This order in clockwise direction is always the same, Thus, criterion depth of rush enables to compare different fabrics according to their total counters reader evaluations. pressure measurement N/cm2, maximum force, reseat force, diameter of rush, diameter of road, time, depth of rush, and fabric thickness are defined. The dangerous zone in which the specimen can be jammed during its extraction locates at the outer contour of the pads rush. The jamming phenomenon is related with the thickness and the radius of the specimen. Tester device the size of the specimen is similar to those used in other devices of the same type: *h = 0.3 cm.* for heavy fabrics, *h = 0.5 cm*. for medium fabrics , *h = 0.4 cm.* for light fabrics, which allow to observe and to capture the variations of specimen’s shape during the extraction. The rating is given by the three digital counters processing based system for thickness in the specimens. Scale which is used in the subjective assessment of fabric thickness varied from 1 to 3.5 cm. In order of their superiority geometrical weft knitted fabric structure model are: loop width Ωr, loop height Δr, loop length ℓpi,

$$\ell pi = \pi \Delta r - \Omega r \tag{1}$$

$$p_1 = 2d\,p_i + d_2 \tag{2}$$

$$p = 4d\,p_i + 3d_2 \tag{3}$$

Where: ℓ- is loop length [mm], Δr - is loop height , p_1-space between wefts of loop fasted , *p*- widths repeat, $d\,p_i$ - is weft knitted fabric structure, yarn thickness[mm].

The loop length is influenced by the yarn input tension, weft knitted fabric structure take-down tension, velocity, materials friction in the weft knitted zone, yarn structure and properties, yarn linear density, etc. The weft knitted vertical density W:is defined by the plain weft structure density and the yarn input tension; it changes only slightly with the change of the yarn input tension for conventional yarns for elasticized. The vertical density of the plain structure changes with depth change. The loop length increases and simultaneously the vertical density is reduced. The relaxation shrinking can easily be monitored through the changes of the vertical and horizontal density and the mass per unit area repeated. The determination of the shrinking is very Important when planning the materials quantity of the fabric to be weft knitted fabric structure to the main structural parameters of weft knitted fabric structure are: the head of loop-spacing (*p*): widths repeat. The weft knitted fabric structure vertical density (w) and the thickness of the weft knitted fabric structure , yarn ($d\,p_i$). The rest of the geometrical parameters required for the complete description of the structure derive analytically from them. Thus the yarns are represented as homogenous cylinders of constant diameter for weft knitted fabric structure and ground, with initial restricted contact area between them.

The thickness properties can be measured by digital counters processing system. Canny edge direction technique is used for the measurement of durability in fabric. And edge is a property attached to an individual force for depth and is calculated from the digital counter function behavior having magnitude of the gradient and direction. The direction of depth should be oriented perpendicular to the edge. If the digital counters is the normal to the edge is estimated as due to the symmetry of the unit cell the length of the weft knitted fabric structure is received by the equation 4.

$$T_C = N_{Fs^2}\left(\frac{\pi(d_1+h_1)}{180\sqrt{d_1^2+2d_1d_2}} + N_{Rs^2}(\pi\Delta r - \Omega r)\cos^{-1}\frac{Cd_1}{(d_1+d_2)}\right)^{-1} \quad ..(4)$$

W

here: $d1$ - diameter of horizontal yarn , $d2$ - diameter of vertical yarn , N_{Fs^2} - maximum force, N_{Rs^2} - force after rest, ℓ - is loop length [mm], Ωr -is loop width [mm], Δr - is loop height [mm], R - distance pleated circumference , r - distance of road circumference, T_1 - time for depth in rush, T_2 - time of reset in rush, h - depth of loop, T_C - thickness of fabrics, C - total of loop.

For detection of geometric characteristics of structure of the weft knitted fabric structure of cotton, polyester, viscose rayon, blended (polyester/cotton), for weft of cotton (the same fabric as used for measuring of bending rigidity) and hysteresis, under bending load, the method of direct research of inner structure of fabric was used. The evaluation of the geometrical model is based initially on the comparison of the experimentally defined thickness of given fabric to the respective calculated by the geometrical model for the same main parameters single jersey fabric. The main structural parameters of a fabric can be defined after a microscopic observation and the thickness can be measured using the new tester. The main parameters, the measured fabrics thickness, and the geometrically calculated thickness for twenty randomly selected fabrics. In order to determine the agreement among the digital counters thickness and weight, the coefficient of concordance. The difference between them is essential. Intermediate shapes between mentioned are obtained for fused textile systems for woven and knitted fabrics. Fig. 4: structure weft knitted fabrics(b) as normal at left, (c) with light pressure, medium in(d), and heavy pressure in(e).

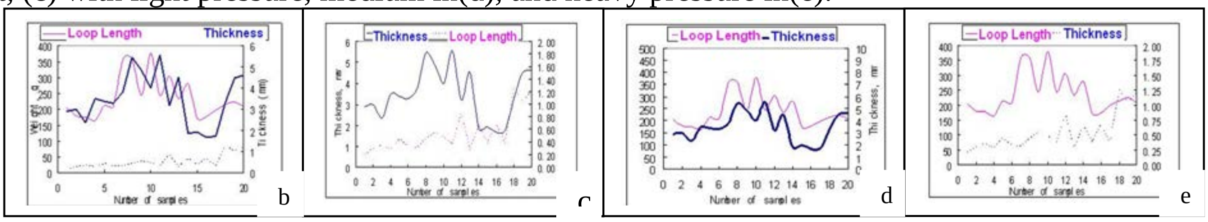

Figure 4 (b,c,d,e): relationship between thickness and loop length

In the case of restrained extraction when rounded specimen for knitted fabrics are pulled through the rush of the pad an interesting transformation of specimens shape are taking part. These changes become significant when outer contour of specimen approaches the rush of the pad, i.e. approaches the value of thickness for knitted fabrics, the analysis of specimens projections at different stages of deformation have shown that geometrical shapes of fabrics can be mathematically approximated with sufficient accuracy using the expressions of shortened epicycloids. While the shapes of thickness of knitted fabrics are using the expressions of «Cassini» ovals and shortened epicycloids. The results of distance measurements from specimen's contour to its centre showed close relationship with the above mentioned models and that parameters can approximate the outer contour of knitted specimen with sufficient accuracy.

Conclusion

Functional prototype of smart digital thickness test method® for velvets and knitting clothes unlike a visual and a form study prototype, a bears the highest resemblance to the actual component insomuch as it can be used to test the actual function of the component of digital thickness test method. Although they are often made at a reduced scale to save money on materials, a final true-to-scale prototype should be made and checked for design flaws before ordering a product run of the component. This prototypes serves a different role in pre-production process, prototypes vary from the final component in several key ways. First of all, the production for velvets and knitting clothes methods used in creating a prototype often substantially differ from those used to create the final component. Whereas expensive quality materials are often used in a production run, materials that bear a resemblance to the final product's desired look and feel are often used instead. This yields a prototype that is fine for visual inspection, but not well-suited to performing the intended component function.

Smart Sustainable Development of Digital Thickness Test Method is the concept of sustainable development will be overviewed where its effect as an Innovation in the Supply Chain Management will be highlighted of Sustainable development. In order to grasp the subtleties of Digital Thickness Test Method the concept, it is important, in the first part, to understand the notion of development, often assimilated to growth, and sustainability, referring to a long-term element. In a second part, the idea is to transpose the concept to the business world through previous research and then in the last part, to describe the interface between innovation Digital Thickness Test Method and sustainable development in order to consolidate the problematic of this research.

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ГИДРОФОБНЫЕ СВОЙСТВА ПОЛИЭФИРСОДЕРЖАЩИХ ТКАНЕЙ, МОДИФИЦИРОВАННЫХ РАСТВОРОМ ТЕЛОМЕРОВ ТЕТРАФТОРЭТИЛЕНА

HYDROPHOBIC PROPERTIES OF POLYESTER-CONTAINING TISSUES, MODIFIED BY SOLUTION OF TETRAFLUOROETHYLENE TELOMERS

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Рассмотрена возможность придания гидрофобных свойств текстильному материалу с помощью теломеров тетрафторэтилена. Охарактеризованы гидрофобные свойства модифицированных теломерами тетрафторэтилена полиэфирсодержащих тканей.

Ключевые слова: гидрофобность, Гидрофобизация, тетрафторэтилен, полиэфирная ткань

The possibility of imparting hydrophobic properties to textile material using tetrafluoroethylene telomers is considered. The hydrophobic properties of polyether-containing tissues modified by telomeres of tetrafluoroethylene have been characterized.

Key words: hydrophobicity, hydrophobization, tetrafluoroethylene, polyester fabric