A COMPUTERIZED SYSTEM TO AID FABRIC INSPECTION/GRADING

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Abstract

A new computerized method of enhancing resolution of defects in a cotton fabric is suggested as a new tool for fabric testing, inspecting, or grading. The method basically involves electronic printing of only one face/side of a fabric with precontrolled dispensing of ink jet on a computer printer. The computer controlled, precise dispensing of ink uniformly disperses the pigment through the fabric substrate, clearly showing any non-homogenities or defects of constituent fibers and yarns on the other "unprinted" side of the fabric. The method may be a useful tool for off-line or on-line examination/inspection of certain fabrics, especially greige or bleached cotton fabrics. A subjective visual examination or, preferably, an objective optical/video image analysis of the fabric's unprinted side provides a clear picture and hence an accurate information on the typical fiber, yarn and fabric defects such as neps; yarn non-uniformity, imperfections and faults; and fabric construction defects, viz., skewness, broken ends, dropped loops, mixed ends, etc.. Using the least expensive, preferably water-soluble, ink/tint in the jet printing (to produce sharper images for quickly and accurately detecting any undesired fabric defects/faults) and any modern, advanced video imaging technology for a remote analytical database, a new approach to fabric inspection/grading is suggested as follows: 1)on-line printing of only one face of fabric (preferably, at intervals that are statistically representative of the entire production) on each production machine; 2)on-line examination of the fabric's "unprinted" side with a traveling video-link camera focussed sharply on the cloth; 3) simultaneous transmission of the video-digitized data to a remote computer control room for an appropriate computerized analysis of the data to assign precategorized defects and to instantly communicat the information back to the machine for proper identification/location of the defects (which may include a permanent freezing/storing of the video images of only the major types of fabric faults/defects in each fabric roll, for records and QC); 4)only a limited manual inspection of cloth rolls having cost-effective mendable defects, based on the computer-generated analyses of the video data; 5) computer dictated quality assignment of the cloth rolls; and 6)random, limited manual fabric inspection for quality control and for monitoring the effectiveness of the computerized system. The proposed system may be more cost effective than the traditional manual inspection of the entire production (which is generally better than 90% first quality, anyway). Because of cotton's excellent dispersion of inks, the system may be more useful for cotton than for other fibers.

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Introduction

Cotton fabrics generally are produced on a number of weaving or knitting machines in a textile mill. Quality of the fabrics produced is extremely important to the textile industry. Historically, an inspector initially inspects the first yard of fabric from each production machine, and if the fabric meets the required specifications and quality standards the machine operator is allowed to proceed to make the production run. Traditionally, the entire production of each machine is manually inspected for quality control, which typically consists of determining and grading only the major physical defects or faults such as slubs, broken ends, mispicks, etc. This practice not only ignores the minor, yet important and quality-sensitive yarn defects such as neps, thick places, thin places, non-uniformity, and non-homogeneity, but also is very expensive considering today's extremely competitive textile manufacturing. Because of too much human involvement and the difficulty of examining a rather difficult-to-examine greige fabric, the present practice of fabric grading and hence evaluation is less than satisfactory for a meaningful quality control.

To cut inspection costs and reduce off-quality production, the textile industry has been evaluating on-line fabric inspection systems for more than 20 years and, in fact, has made a substantial progress toward this goal. Recently, Georgia Tech reported a successful development of an on-line fabric inspection system using an advanced vision technology complex involving a special lighting arrangement, a set of high-speed cameras, neural networks, fuzzy logic and wavelets [1]. The development reportedly has helped improve overall quality. However, at times, the scanning and examining of, particularly, certain greige fabrics and the related complexities of accurately interpreting the computer-generated data to correctly assign the various defects may be quite challenging.

Scientists at SRRC have developed a new, computerized method of solid printing of only one face of the fabric, using a pre-programed PC/color printer to dispense a pre-controlled amount of ink. Because of the computer efficiency and accuracy, the method allows a precise distribution and, hence, dispersion of the ink through the fibrous substrate. Subjective or objective scanning of the other, unpainted side of the fabric pronouncedly reveals any non-uniformities, non-homogeneties, or defects of constituent fibers, yarns and fabric (formation). The

constituent fiber and yarn defects are also important and play a significant role in the determination of the overall quality of the fabric. The so-called objectionable defects or off-quality parameters can be detected and classified either subjectively or objectively. Although much more work is needed to objectively detect and analyze the defects accurately, a subjective evaluation of the defects is rather relatively easy because of the prominence of defects caused by this new, one-side printing technique. Briefly, a fabric, while being produced, can be electronically printed either continuously or intermittently only on its one face, preferably the under face, by means of a pre-programed computer-printer system. There are several such systems readily available.

Methods and Materials

In preliminary investigations, a PC computer printer was programed to deliver a pre-determined amount of (blue) printer ink. Using a suitable software program, a piece of fabric to be examined was solidly (continuously) printed on its under face/side.

Results and Discussion

Figure 1 shows a computerized scan of the unpainted side of the fabric. As seen, practically all types of fiber, yarn and fabric defects and non-homogeneties are clearly visible, most of which would have been extremely difficult, if not impossible, to detect and identify in the traditional methods of greige fabric inspection. Because of the pre-controlled, precise dispensing of printer ink with computer efficiency and accuracy, the other (unpainted) face of the fabric indeed reflects very pronouncedly any non-homogeneity, abnormality, defect, or fault of constituent fiber, yarn and fabric. A subjective visual inspection (and possibly an objective optical image analysis) of the "unpainted" side of the fabric provides sufficient qualitative and quantitative information on the typical textile quality parameters, viz., the fiber neps; the yarn uniformity, imperfections and faults; and the fabric-construction defects such as skewness, broken ends, dropped loops, mixed ends, etc..

Conclusion

An appropriately controlled, electronic solid (continuous) printing of a textile substrate only on its one face offers an excellent view of practically all types of common textile defects, abnormalities, or non-homogeneties of constituent fibers, yarns, and fabric on the other, unpainted side of the substrate. This technique may be very useful in the inspection, grading and quality control of cotton fabrics and other textiles. Efforts are underway to explore reliable and commercially viable methods of objectively, rather than subjectively, detecting and classifying defects in the fabric inspection and grading. Also, a new concept of electronically monitoring the entire production on line and manually inspecting/mending only the pre-registered, defective yardage is suggested.

References

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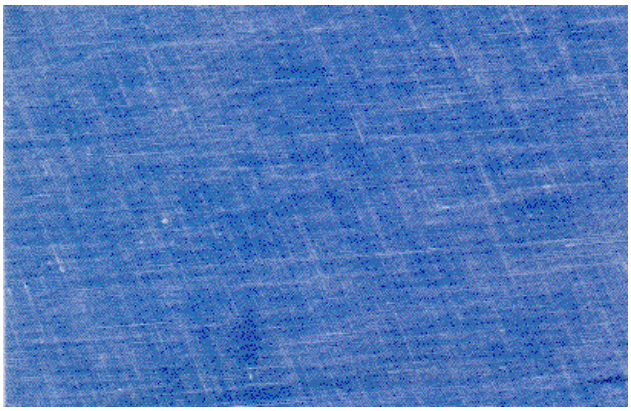

Figure 1. A computer-scanned version of the fabrics' unprinted side.