ITC Research Student Seminar 2016-17

Date: 17 November 2016 (Thursday)
Time: 2:30 pm – 3:30 pm
Venue: Room ST602, 4D Theatre, The Hong Kong Polytechnic University

Speaker: Liu Su (PhD Student)
Topic: The influence of different structures on resistivity of conductive knitted fabrics

Speaker: Tong Jiahui (PhD Student)
Topic: Resistive Property of conductive Fabrics and the Thermal Regulation

Speaker: Zulifqar Adeel (PhD Student)
Topic: Woven Fabrics with Auxetic Behavior

Abstracts

Topic: The influence of different structures on resistivity of conductive knitted fabrics

This study conducts a series of experiments on the resistivity of conductive knitted fabric with different knitwear structures. Resistive network models are developed to determine the resistance values of conductive knitted fabrics with different numbers of wales and courses. Corresponding experiments are carried out to verify the proposed models. Finally, a comparison of jersey (knit), float and tuck stitches is carried out with the relative wales and courses. It is concluded that both float and tuck stitches could reduce the total resistance of conductive knitted fabrics, and between them, tuck structures can provide lower resistance as well as a more

aesthetically pleasing appearance. On the other hand, float structures are more economical, as conductive yarn is expensive so its cost is reduced with use of float stitches as the loop length is much shorter than that of the tuck stitches.

Three thermal knitwear garments are developed in the experiments to test the thermal performance to determine the optimal design from the different knitted structures. It is concluded that the thermal properties are influenced by the different knitted structures and Single Pique has the most optimal performance in terms of the heating effect among the three types of selected structures.

Topic: Resistive Property of conductive Fabrics and the Thermal Regulation

Most recently, heating garments become increasingly popular because they own some good characteristics such as body warming, physical therapy, and assisting drug delivery. However, a comprehensive and scientific research on their working principle has neither been conducted nor published. What's more, a better solution for the power supply of the heating garment is also needed. In this paper, the working principle of the heating fabrics has been studied. Firstly, the electrical resistance of knitted fabrics embedded with conducting yarns at different temperatures was studied. Two types of resistance, linear resistance and contact resistance have been considered and discussed by experimental studies and theoretical modeling. The temperature effect on the resistance of these two conductive knitted fabrics as a function of applied voltages was extensively explored. The results have shown that the resistance of either conductive knitted fabric decreases significantly (maximum 30%) when its temperature is rising. It can be explained by two main factors: the electrical resistance of the silver-coated conductive yarns decreases as temperature rises; the physical contact of the overlapped conductive yarns extends due to heating on woolen fabrics, which causes a decrease in contact resistance. By studying the thermal diffusivity and resistive property, a generalized theoretical model is proposed to help us to predict the temperature of a fabric when both the applied voltage and size of the fabric are obtained.

Topic: Woven Fabrics with Auxetic Behavior

Auxetic fabrics have unusual property of lateral expansion upon stretch. Unlike conventional fabrics auxetic fabrics have zero or negative Poisson's ratio. Auxetic fabrics possess the property to retain the width or to become

wider in lateral (direction at right angle to the direction of stress) direction when stretched in longitudinal direction and return to their original dimensions when stress is removed. This occurs due to their hinge-like structures, which flex when stretched. It is claimed that auxetic materials have enhanced mechanical properties like shear modulus, energy absorbance, vibration damping, sound absorption, sync-elastic behavior and better formability. Up till today auxetic fabrics has been produced by using special auxetic yarns or conventional yarns. Auxetic fabrics produced by using conventional yarns and machinery have gained extraordinary curiosity of researcher in recent past years. Though auxetic fabrics have successfully developed by using conventional yarns and knitting technology, but auxetic fabrics developed by using conventional yarns and weaving technology is still a research area that required to be explored. This study aims to demonstrate few possibilities of designing and fabricating a novel class of stretchable auxetic woven fabrics for clothing material by using readily and inexpensively available conventional elastic and non-elastic yarns and conventional weaving machinery.

~All are welcome~