ITC Research Student Seminar 2015-16

Date: 25 January 2016 (Monday)
Time: 2:30 pm – 4pm
Venue: Room MN109, The Hong Kong Polytechnic University

Speaker: Cheng Chun Man (PhD Student)
Topic: Impact of Fabric Moisture Transfer Properties on Physiological Heat Strain of Firefighters during Simulated Rescue Training

Speaker: Liu Yang (PhD Student)
Topic: Stimuli-responsive high performance graphene-titania binary system

Speaker: Lo Ka Wai (PhD Student)
Topic: Application of Digital Printing in Unconventional Knitwear Design

Speaker: Tong Le (PhD Student)
Topic: Computer Vison-based Automatic Fabric Defect Detection for Apparel Industry

Abstracts

Topic: Impact of Fabric Moisture Transfer Properties on Physiological Heat Strain of Firefighters during Simulated Rescue Training

The study was aimed at investigating the thermo-physiological responses and the change of heat strain when wearing different designs of uniform with specific fabric properties in rescue operation of firefighters.
Method: Ten healthy male firefighters performed the training according to the guideline and procedure of formal training in Fire Services Department

to simulate the actual rescue condition, in high temperature and humid condition controlled by the chamber. Two sets of uniforms are used to identify the key factors in selecting fabrics and uniform designs that could have significant influences on the thermoregulatory stresses of firefighters.
Measurement: Core temperature, heart rate, micro-climate temperature and humidity, and mean skin temperature were collected in different subjects. Physiological strain index (PSI) values were calculated using the formula developed by Moran.
Result: The Core temperature, heart rate, skin temperature and micro-climate condition were increased significantly during the training sessions compared to the resting sessions. PSI values resulted in moderate to high levels of heat strain during the simulated firefighting activity. The thermal physiological stress and feeling sensations of firefighter were identified in order to compare the performance of uniform with different fabric properties.

Topic: Stimuli-responsive high performance graphene-titania binary system

Extraordinary performance in terms of efficiency and diversity can be obtained in the graphene-titania binary system. According to the ancient Chinese Taoism, the ultimate universe can be generated by the interaction between the "Yin" and "Yang" aspects. In the graphene-titania binary system, the "Yin" and "Yang" characteristics between graphene and titania are interacted dynamically to generate novel smart functions. When this binary system was applied onto the fabric surface, stimuli-responsive rapid surface superhydrophobic to superhydrophilic conversion can be readily obtained, which further facilitated novel applications such as directional water transportation and droplet manipulation. In addition, high speed oil/water separation can also be realized by using only the fabric as the filtration membrane, as a result of the robust anti-wetting characteristic generated by the binary system. In conclusion, stimuli-responsiveness, multifunctionality, and superhydrophobicity were obtained on the fabric surface by applying the graphene-titania binary system, which clearly indicated the unprecedented application potential for this novel integrative system and the scientific value of the "Yin" and "Yang" theory.

Topic: Application of Digital Printing in Unconventional Knitwear Design

The purpose of research was to apply digital printing to unconventional knitwear design. The investigation focused on design process and development, as well as production of design.

Digital printing has been a popular trend in textiles and clothing along with the rapid growth of computerization, allowing generation of digital images on the surface of fabric / garment by related design software and ink-jet printer. Such printing technique has been newly applied to knitwear design since the last decade. In current practice, traditional designs of digitally printed knitwear are 2-dimensional, by which printing process is relatively easy to be handled in manufacturing. However, the fashion trends become more diverse nowadays and the silhouettes of knitwear are no longer in 2-dimensional format. Sweaters with sculptural or architectural shapes could be knitted accompanied with the advancement of knitting techniques. The research was inspired based on this current knitwear fashion trend.
In this practice-based design research, Methodological development and critical analysis of design and production process were illustrated. A series of artifacts were created based on the experiments and knowledge of related aspects. The significance of this research could generate a systematic design model for application of digital printing in unconventional knitwear design and provide guidance in design and production process.

Topic: Computer Vison-based Automatic Fabric Defect Detection for Apparel Industry

Quality control plays a crucial role in the apparel industry in order to maintain its competitive edge in the global market. Since fabric are the main and costly raw materials of a garment, it is very important to successfully locate the fabric defects before cutting process. Traditionally, this quality control is done by human inspection which is of high labor cost. However, the reliability of human inspection system is quite poor because fine defects are very difficult to be noticed, and human error occurs due to fatigue. In this research, imaging devices and image processing techniques are utilized to develop automatic woven fabric inspection system which can successfully identify and locate possible defects. Based on the analysis of the particular characteristics of fabric defects, a differential evolution-based optimal Gabor filter model is proposed to solve line-shaped defects. Moreover, a dictionary learning-based defect detection model is proposed for tackling those tiny defects which appear on fabric with coarse structure. The results of the experiments on real fabric samples show the effectiveness of the proposed detection system for fabric defect detection.

~All are welcome~