ITC Research Student Seminar 2015-16

Date: 22 February 2016 (Monday)
Time: 2:30 pm – 3:30pm
Venue: Room MN109, The Hong Kong Polytechnic University

Speaker: Hu Enling (PhD Student)
Topic: Regeneration of highly polluted textile dyeing effluent through catalytic ozonation for reuse of wastewater and electrolyte

Speaker: Li Ming Yi (MPhil Student)
Topic: The development of maternity support garment for the use during extended period of standing and walking

Speaker: Zhao Kaiwei (PhD Student)
Topic: A integrated method to simulate human foot function through anatomical modeling

Abstracts

Topic: Regeneration of highly polluted textile dyeing effluent through catalytic ozonation for reuse of wastewater and electrolyte

Reactive dyeing of cotton generates large amount of colored wastewater containing residual dyes, electrolyte, alkali, and other chemical auxiliaries. This report presents a new technology to regenerate dyeing effluent from the first dyeing bath through catalytic ozonation with novel catalysts for reuse of both the wastewater and electrolyte from the spent effluents in successive dyeing. Two novel ozonation catalysts, carbon aerogel (CA) and CA supported cobalt oxide (Co_3O_4/CA), were successfully prepared and used in

catalytic degradation of the organic pollutes in waste effluents with ozone. The enhancement of dye degradation was determined by decolorization and removal of chemical oxygen demand (COD). The result shows that novel catalysts could improve these two targets significantly. For COD removal, Co_3O_4/CA strikingly enhanced the efficiency by 30% on the whole comparing to ozonation alone. Spent effluents after catalytic ozonation were then used in successive dyeing in the same process. It is validated that the waste effluent had been successfully regenerated and could be additionally reused twice without sacrificing color quality of the dyed fabric, which could not be realized in solo ozonation without catalysts. This technology demonstrates great potential of catalytic ozonation in reuse of wastewater and electrolyte from dyeing effluents to reduce pollution.

Topic: The development of maternity support garment for the use during extended period of standing and walking

50–70% of pregnant women have experienced some form of LBP during pregnancy. Low back pain is a common medical problem of pregnant women as a result of growing uterus and hormonal changes. A feasible and common therapy would be applying supportive maternity wear to eliminate low back pain. Current maternity garments may not provide all round support with comfort to pregnant women, especially during the third trimesters. This project aims to develop a comfortable maternity support garment for use during extended period of standing and walking. The study has investigated the current local market of maternity support garment and discovered only maternity belt is available in Hong Kong. Four maternity support garment prototypes with popular features have been generated. Mechanical properties of fabrics has been evaluated and the most suitable fabric to minimizing the embryo swaying with acceptable comfort level has been selected. Preliminary study of the four prototype has been conducted, which included anthropometric measurements, embryo motion while standing and walking respectively, and human psychological perceptions of comfort with and without wearing the prototypes. Final maternity support garment has been developed and further investigation is suggested.

Topic: A integrated method to simulate human foot function through anatomical modeling

Human foot modeling plays a key role in anthropometry, biomechanical analysis and footwear customization. A detailed accurate foot model can

make a significant contribution to simulation and prediction in terms of its geometric structures for product design.

In this study, OpenSim platform is adopted to simulate basic human movement mechanics by modeling foot motion parameters and muscle force. An integrated anatomical foot model, including the skeletal and all the muscles (both extrinsic and intrinsic), is developed based on a consistent lower limb anatomy database and valid anatomy atlas. The whole skeleton is divided into 9 segments when many factors are considered such as insufficient flexibility to mimic the detailed 3D motion of the conventional three segment model; and dense markers on foot affect the motion capture accuracy and cause noise. As a result, the foot muscles also have enough degrees of freedom in order to deform, making the simulation closer to real foot motion. Key parameters to muscle modeling, such as maximum isometric force, optimal fiber length and tendon slack length, are determined either from empirical and average values, or through numerical computation based on muscle physiological mathematical model. Inverse kinematics is executed using weighted least square method in order that the distance error between the experimental markers and the specified anatomical landmarks can be minimized. Kinetic analysis, i.e. Static optimization, is performed to calculate foot muscle forces at concerned frames during the motion. Results indicate that the foot motions can be adequately simulated. More research are being carried out to validate the dynamic foot model.

~All are welcome~