Actual thematic areas for Ph.D. study program realized at Faculty of Textile Engineering Technical University of Liberec

Selecting of the focus of the study, the supervisor and the department is very important and it is necessary to pay attention to it. Concrete idea about the research priority areas and topics that are currently solved at departments of Faculty of Textile Engineering Technical University of Liberec, can be find out in official documents published at official web site. Detailed view about fields and problems that supervisors pay interest you can find out in actual thematic areas of doctoral study. These areas are not complete list of topics which the applicant can select. After consultation with the supervisor and the head of department is also possible to define topics which are not explicitly mentioned in this offer. The details you can get from following sources:

http://www.ft.tul.cz/en/research
http://www.ft.tul.cz/en/labs
http://www.ft.tul.cz/en/departments/

Topics of dissertation works for the applicants studying in doctoral study program in Czech or English language

Theme: Electro-hydrodynamics and Thermodynamics of the Fibre Spinning Process

Supervisor: Prof. RNDr. David Lukáš, CSc.
Contact email for more information: david.lukas@tul.cz

The work is focused on the analysis of hydrodynamic stability of viscous polymer jets produced, for example, by electrical spinning or drawing. The goal of the analysis is an estimate of the parameters of the fastest growing instability of the Plateau-Rayleigh type. Another objective of the proposed work is to study the formation of the solid fibre spun from a polymer solution. This process has the character of the rapid phase transition between liquid and solid.

Theme: Properties of Nanofibrous Materials for Medical Applications

Supervisor: Prof. RNDr. David Lukáš, CSc.
Contact email for more information: david.lukas@tul.cz

The theme of the work is an analysis of physical and mechanical properties of materials being developed as medical devices and scaffolds for tissue engineering. According to previous scientific erudition of the student, the research work will be focused on either the adhesion and friction of nanofibrous materials to models of skin wounds or the study of cellular diffusion using the methods of random walks and percolation in fibre 3D objects. The three-dimensional structure of fibrous objects will be investigated from micro-photographs obtained by micro-CT.

Theme: Development of Electrically Highly Conductive Textile Structures
Supervisor: Prof. Ing. Jiří Militký, CSc. (Ing. Veronika Tunáková, Ph.D.)
Contact email for more information: jiri.militky@tul.cz

The aim of the dissertation is to develop and optimise the methodology for application of various metals on fabric structures for purposes such as: (a) obtaining a flexible textile layer protecting electronic information against misuse, (b) creating a conductive path for the transmission of information, (c) creating of camouflage material capable to absorb or reflect incident electromagnetic radiation, and the like. Metal coating will be realised by autocatalytic deposition of a chosen metal of submicron thickness by interaction of metal salt and a reducing agent.

Theme: SMART Textile sensors based on nanofibrous structures
Supervisor: doc. Ing. Martina Viková, Ph.D., doc. Ing. Pavel Pokorný, Ph.D.
Contact email for more information: martina.vikova@tul.cz pavel.pokorny@tul.cz

We many times meet such kind words as smart materials, intelligent materials with application of functional colorants (dyestuff or pigments). The functional colorants can be applied on the different kind of substrate (textile, paper, polymeric matrix and etc.). These materials react on external stimulus by specific color change. The intensity of color change is given by the intensity of external stimulus. Such kind of colorants we can call as chromic or functional colorants. This external stimulus can be UV-VIS radiation, temperature, and electricity power, voltage and also solvent or chemicals etc. In this case is not necessary to use difficult electronic devices with so high price, but we can use such kind of colorants as indicator or sensorial system for measurement of intensity or external stimulus level.
Micro/nanofibers have many unique characteristics, such as high surface-to-mass (or volume) ratios, and the ability to form highly porous fibrous membranes. Nanofibers can be produced by melt blowing, flash-spinning, bi-component spinning, and force-spinning (or centrifugal spinning). Electrospinning can also be used to fabricate micro/nanofibers, and electro spun fibers have been used for applications such as filters, scaffolds, enzyme carriers, and sensors.
Photochromic dyes, such as spiropyrans (SPs), are both functional and dispersible, and the chemical structure of the SPs is similar to that of traditional dispersible dyes that are used for textiles. One unique property of photochromic dyes— reversible photo isomerization—has attracted considerable interest with regard to applications in photochromic windows and eye-protection, rewritable optical data storage, drug delivery system, mechanophores, and X-ray radiation detection.
The aim of this research is to investigate the formation of these fibers and the effects of various parameters, including the concentration of the polymer solution (as reflected in the viscosity), the spinneret rotational rate, and the internal needle diameter, on the fiber morphology and photochromic properties of the fibers.

Theme: SOL-GEL surface treatment with application of color-changeable pigments
Supervisor: doc. Ing. Martina Viková, Ph.D., doc. Ing. Michal Vik, Ph.D.
Contact email for more information: martina.vikova@tul.cz, michal.vik@tul.cz

Major attention has been given to research, development and perfection of protective clothes, especially their barrier features. For these protective barriers, it is important to understand how clothes or textiles protect the wearer against the above-mentioned dangerous conditions associated with UV irradiation, dangerous gasses extreme heat, etc. and if the protection is only partial or the protection is time limited by ambient conditions.
Photochromic coatings on different substrates with controlled photochromic properties are done by the usage of organic-inorganic hybrid coatings. The hybrid coatings have the appropriate porosity and surface activity required to obtain the photo and thermochromic effects. Main task of this proposal is focused on sensorial textiles, which reacts by changing color because of its dependence on external stimulus (light, gas, temperature, etc.). Special purpose is color changeable textile production in point of view of application of mass dyeing and other continuous methods of textile materials dyeing.

Theme: Pedestrian Conspicuity: The Effects of Phosphorescent Sign and Retroreflector Placement
Supervisor: doc. Ing. Michal Vik, Ph.D., Ing. Martina Viková, Ph.D.
Contact email for more information: michal.vik@tul.cz, martina.vikova@tul.cz

In recent years, the rapid development of traffic industry leads to high increase of road construction, reconstruction and private car ownership, bringing convenience to our daily lives, and also high-frequency traffic accidents. To strengthen the personal safety protection, the market demand for high-visibility clothing is expanding. The application covers such departments and industries as police, first aid, postal express, sanitation, airport and construction..., even campus and people's

daily lives. High-visibility clothing has gradually become an integral part of our lives and even the necessary personal protective equipment.
In comparison to other methods of increasing visibility distance (e.g. by using flashlights) retroreflective and phosphorescent material has the practical advantage of having a long lifespan and being independent from having an internal power source. Nevertheless, there are some disadvantages to using retroreflective material. Consequently, it is important to understand the reflective properties of retroreflective material because it is almost never functioning at optimal performance, as well as phosphorescent pigments.
The field photo-luminescence is split into two groups; the fluorescent and the phosphorescent materials. Among all the four kinds of luminescence phenomena, photo-luminescence is the only one that is self-shining in the field of luminescent materials, so it is more likely to be used as an extra illuminating function. Phosphorescent materials are known in the field ink, paint and tapes; and they are also used on clocks, light switches, some stickers, fishing net, artificial baits, etc. Fluorescent materials are mostly used in textile-applications like filaments, coatings, or signalization (cloth and equipment for work wear/sports etc.). It is clear that there is a potential demand of luminescent material in the current fire garments market. In the future, the need for materials to improve the visibility will increase together with new developments of the special garments for rescue tasks.
The aim of this research is to investigate combined effect of three common systems for improved conspicuity such as fluorescence, retroreflectance and phosphorescence together with study related to biological motion information, aging and soiling of developed high-visibility clothing.

Theme: Color managing for ink-jet printed textiles containing fluorescent whitening agents
Supervisor: doc. Ing. Michal Vik, Ph.D., doc. Ing. Martina Viková, Ph.D.
Contact email for more information: michal.vik@tul.cz, martina.vikova@tul.cz

The role of a color-managed inkjet proof is to predict and simulate the visual appearance of printed color. The proof-to-print visual match works well under different viewing conditions when the input ICC profile and the output ICC profile, built from characterization datasets, do not contain fluorescent whitening agents (FWA).
FWAs influence printed color when measured for characterization and viewed. These whitening agents absorb UV wavelengths in the illuminant and fluoresce in the blue wavelengths. As more and more FWAs are used in printing textile production, the role of color proofing becomes more difficult. The difference in the amount of the UV component of the measuring and viewing light sources cause a problem where the FWA effect, as measured, may not be the same amount of FWA effect that should be proofed under the viewing illuminant. These problems are obviously addressed with difference in SPD (spectral power distribution) of indoor artificial light sources such as LEDs, HPS, fluorescent tubes, etc. in relation to outdoor daylight, which is used as reference light during measurement of colorimetric parameters of textiles used for inkjet printing.
There are two objectives in this research project. The first objective is to show how printed colors, under identical printing conditions on FWA and non-FWA textile substrates, look different than when they are proofed using current characterization for proofing practices. Both TD0 (UV-included) and TD1 (UV-cut) measurement data will be collected from color patches with selected tonal values and input ICC profiles created from this data to be used to proof the brightened reference print. Known results show that the UV-cut characterization treatment produces a very poor proof to the reference, while the correct UV-included proof is frequently ranked as a fairly high match. The second objective is to propose different ways the characterization data can be adjusted for the FWAs in a reference print on brightened textiles, by accounting for the influence of UV in the measurement illuminant, and the influence of UV in the viewing illuminant. By means of psychometric analyses, the current results show that the proof-to-print match is the worst when FWA in textile print and UV in the measurement illuminant are not addressed. The aim of this research is to investigate the improved proof-to-print match when FWA are present in print, different amount of UV in the measurement illuminant, and different amount of UV in the viewing illuminant are addressed.

Theme: Modelling of Geometric Roughness of Woven Fabric Structures
Supervisor: Ing. Brigita Kolčavová Sirková, Ph.D.
Contact email for more information: brigita.kolcavova@tul.cz

Roughness is generally defined as the surface quality, or as a micro-geometry of the surface relief. Roughness refers to the total surface unevenness with a relatively small distance. The properties of the surface layer and roughness significantly influence the total comfort and durability of the fabric product. Functional surface properties are determined by their geometric parameters. The accuracy of geometric parameters is given by the sum of their deviations from ideal geometry. The variations are defined as differences of the actual shape of the surface and surface shape of the nominal geometry.
The basic information about inequalities and their variations can be obtained from the profile (cross sectional view), which arises as the intersection of the cutting plane perpendicular to the surface of the object. The profile of inequality is decomposed into components corresponding to the individual parameters of geometric inaccuracies. The shape and waviness are referred to as macro-geometry, while roughness as microgeometry. The aim of this research task is to analyse the surface of the dobby woven fabrics as well as jacquard woven fabrics from geometric surface viewpoint, and then to model geometric roughness of a woven fabric structure on the basis of planar and spatial geometry of the woven fabric construction.

Theme: Evaluation of Yarn Appearance
Supervisor: Ing. Eva Moučková, Ph.D.
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The yarn appearance is one of parameters for a yarn quality evaluation. In practice, the yarn appearance is evaluated subjectively comparing a yarn board of a defined winding density with a standard yarn board according to ASTM D 2255-90, the Standard Test Method for Grading Spun Yarns for Appearance or according to the standard in the norm ČSN 80 0704, Determination of yarn appearance. The evaluation is dependent on the reviewers and their visually distinctive capabilities. There were suggested methods for the objective evaluation too, but they are not widely used. The aim of this work is to chart the existing methods for yarn appearance evaluation, to propose and experimentally validate the objective method using yarn characteristics, yarn appearance in the area and standard ASTM D 2255-90 or ČSN 80 0704.

Theme: Thermophysiological Comfort of Seats for Professional Drivers
Supervisor: Prof. Dr. Ing. Zdeněk Kůs (Assoc. Prof. Ing. Antonín Havelka, CSc.)
Contact email for more information: antonin.havelka@tul.cz

The aim of this project is to focus on theoretical analysis of transport principles in textile sandwich structures with an orientation on the heat and moisture transport to optimize thermophysical comfort of the seat. An additional part will be an analysis of methods for the measurement of evaporative resistance Ret with reference to the car seat.

Theme: Dynamic Stress of Sewing Thread in the Development of Lock Stitch
Supervisor: Prof. Dr. Ing. Zdeněk Kůs (Assoc. Prof. Ing. Antonín Havelka, CSc.)
Contact email for more information: antonin.havelka@tul.cz

The aim of this work is to define the mechanical stress in the process of thread sewing, monitor its dynamic loading, as well as tensile ductility and other properties (e. g., viscoelasticity, stress relaxation) in various stages of the stitching process. Dynamic and static strength of sewing threads will be compared. The study will also focus on the speed and wear and tear of the sewing thread occurring during the process of its passing through the needle.

Theme: A Study on Sewing of Technical Clothing
Supervisor: Prof. Dr. Ing. Zdeněk Kůs (Assoc. Prof. Ing. Antonín Havelka, CSc.)
Contact email for more information: antonin.havelka@tul.cz

Technical clothing like firefighter clothing needs special threads and machine settings to produce highly functional garments. In this research special threads like Meta & Para- Aramid, conductive threads and high-strength polyester thread will be tested for the seam performance and life time of technical clothing. A special emphasis will be placed on the loss of tensile strength of thread due to friction from the needle and abrasion from the machine parts. Optimization of machine setting and effects of different factors (machine speed, lubrication, coatings) will be part of the research project. Finally, a numerical or analytical model will be made to describe the process theoretically.
Requirements: Student must have thorough knowledge of sewing machines and at least fundamental level in theoretical modelling.

Theme: Pattern Construction Method Development of Compression Textile Products for Medical Treatment

Supervisor: Ing. Petra Komárková, Ph.D.
Contact email for more information: petra.komarkova@tul.cz

Invention: Application of anthropometry in clothing technology. Study of the mechanical interactions between the body and compression garments. The aim: Prediction of pattern construction parameters of compression garments. Content: Study of correlation of body dimensions, finding out prediction equations for determination of design parameters of compression clothing. Creating a suitable material model and its verification. Modelling of compressing effects of compression clothing on the human body, creating a finite element model. An algorithm development of parametric pattern construction of compression clothing.

Témata disertačních prací pro studenty doktorského studijního programu studující v českém jazyce

Téma: Strukturní modelování souvislostí mezi tahovým namáháním příze a vláken, včetně jejich pevností
Školitel: prof. Ing. Bohuslav Neckář, DrSc.
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Křivky napětí - poměrné prodloužení jakož i hodnoty poměrné pevnosti a tažnosti vláken a příze se významně liší v důsledku specifické struktury staplové příze a osobitého chování vlákenných svazků. Dopady dílčích projevů mechanického chování vláken na výslednou křivku napětí - prodloužení příze, především vliv tvaru pracovní křivky průměrného vlákna a vliv orientace vlákenných úseků v přízi, byly již řešeny (a publikovány) na KTT. Nezahrnovaly však oblast přetrhu příze, problematiku prokluzů vláken při tahovém namáhání příze, vliv „svazkového" chování vláken v přízi, apod. Navrhované téma doktorského studia má klasický charakter teoreticko-experimentální.

1) V teoretické oblasti se navrhovaný výzkum bude týkat rozšíření matematického modelu vztahu vlákno-příze:
   a) do oblasti přetrhu příze, pravděpodobně s využitím „svazkového" charakteru chování vláken,
   b) vytvoření alespoň částečného modelu prokluzů vláken při tahovém namáhání příze.
2) Na teoretické modely navazující práce v experimentální oblasti se budou týkat:
   a) vypracování metodiky, měření a vyhodnocování křivek napětí - prodloužení jednotlivých vláken, vlákenných svazků a staplových přízí,
   b) vypracování metodiky, experimentálního sledování a vyhodnocování prokluzů vláken při tahovém namáhání příze.
3) Porovnání teoretických modelů s experimentálními výsledky pro vybraný okruh vláken a přízí.

Téma: Transformace hmotové nestejnoměrnosti v technologii předení
Školitel: prof. Ing. Petr Ursíny, DrSc.
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Určení změn hmotové nestejnoměrnosti ve vybraných stupních technologie předení s hlavním zaměření na systém bezvřetenového rotorového dopřádání s využitím prostředků simulace spřádacích procesů. Tvorba dynamických a pravděpodobnostních modelů pro optimalizaci technologického procesu za podmínek vysoké výrobnosti rotorového dopřádacího systému. Možnosti zkracování celkové přádelnické technologie přípravy předlohového vlákenného produktu pro rotorové dopřádání.

Téma: Biomechanická studie podprsenek pro pacientky po rekonstrukční operaci (Marek Kovář)
Školitel: doc. Ing. Lukáš Čapek, Ph.D.
Kontaktní email pro bližší informace: lukas.capek@tul.cz

Ablace prsu a jeho následná rekonstrukce patří mezi časté chirurgické zákroky postihující ženy napříč věkovými skupinami. I přes svůj častý výskyt se jedná o zákrok, který je velmi variabilní a může být provázen množstvím komplikací. Jedná se o objektivní biologické (hojení rány, reakce na cizí těleso apod.), ale i psychosomatické komplikace. Primárním cílem práce je navrhnout optimální tvar a materiál podprsenky pro ženy po rekonstrukci prsu. Sekundárním cílem je vytvořit biomechanický model hrudníku po rekonstrukční operaci a jeho následnou interakci s podprsenkou. Vstupními parametry jsou: vlastnosti kůže, tvar implantátu, výsledná jizva, materiál podprsenky a její tvar.

Téma: Hybridní bio-textilní náhrada pro aplikaci v popáleninové chirurgii
Školitel: doc. Ing. Lukáš Čapek, Ph.D.
Kontaktní email pro bližší informace: lukas.capek@tul.cz

Popáleniny lidské kůže a jejich následná léčba je velmi častým poraněním postihující všechny věkové skupiny, nicméně patří mezi nejzávažněji v dětském věku. Zavedeným standardem je tzv. síťování kožních štěpů. Tato metoda je historicky ustálená, nicméně má mnoho limitujících faktorů. Hlavním z nich je velikost kožního štěpu a jeho následná expanze. Dlouhodobým cílem popáleninové chirurgie je vývoj umělé kůže. Cílem práce je vytvoření mezičlánku mezi těmito dvěma přístupy, tj. vytvořit hybridní bio-textilní náhradu, která by kombinovala výhody obou přístupů. Prvním krokem bude vývoj optimální velikosti sítě kožního štěpu (počítačový model). Druhým krokem bude vybrání vhodného textilního nosiče a jeho interakce s kožním štěpem.

Téma: Vliv konstrukce vazby osnovní oboulícní pleteniny (spacer warp knitted fabric) na její stlačitelnost
Školitel: Ing. Irena Lenfeldová, Ph.D.
Kontaktní email pro bližší informace: irena.lenfeldova@tul.cz

- analýza vlivu typu kladení prostřední vrstvy většinou tvořené monofilem především na její stlačitelnost,
- možná změna vlivu úhlu monofilu u jednotlivých typů vazeb.

Téma: Komfort textilií odolných vůči zvýšeným teplotám
Školitel: doc. Ing. Vladimír Bajzík, Ph.D. (prof. Ing. Luboš Hes, DrSc.)
Kontaktní email pro bližší informace: vladimir.bajzik@tul.cz

Cílem disertační práce je navrhnout vrstvenou textilii se zvýšenou tepelnou odolností se zlepšenými transportními vlastnostmi pro vlhkost. Součástí je dovyvinutí přístroje pro měření tepelného odporu při působení nadměrného tepelného záření (vyšších teplotách než 100°C) a vytvoření modelu.

Téma: Kvalita příze versus její užití v následném zpracování
Školitel: Ing. Gabriela Krupincová, Ph.D.
Kontaktní email pro bližší informace: gabriela.krupincova@tul.cz

Zjišťování kvality příze bez ohledu na účel použití příze v následném zpracování není relevantní. Cílem disertační práce je pokusit se pochopit způsob, jak se vlastnosti příze ve vybraných výsledných produktech (plošných textiliích různé konstrukce) projevují a definovat požadavky související s vybranými technologickými operacemi použitými pro jejich zpracování do finálního výrobku.

Téma: Vývoj metodiky střihové konstrukce oděvních výrobků určených pro léčbu tlakem
Školitel: Ing. Blažena Musilová, Ph.D.
Kontaktní email pro bližší informace: blazena.musilova@tul.cz

Invence: Aplikovaná antropometrie v oděvnictví. Studie mechanických interakcí mezi povrchem lidského těla a kompresním oděvem. Cíl: Predikce konstrukčních parametrů střihů kompresních oděvních výrobků. Obsah: Modelování vztahu mezi tělesnými rozměry, hledání predikčních rovnic pro stanovení konstrukčních parametrů střihů kompresních oděvů. Tvorba vhodného materiálového modelu a jeho ověřování. Modelování svěrných účinků kompresního oděvu na lidské tělo, vytvoření konečně prvkového modelu. Vývoj algoritmu parametrické střihové konstrukce kompresních oděvů