ROYAL INSTITUTE OF TECHNOLOGY

Positions available at KTH Royal Institute of Technology for entry academic year 2020 for Chinese Scholarship Council (CSC) appilcants

Contents

Full PhD study: 48 months

Urban and Regional Studies (Reg. No. 2001)

Type of position Full PhD study: 48 months		**Main supervisor** Hans Westlund
KTH School ABE		**Co-supervisor(s)** Tigran Haas
KTH Department Urban planning and environment		**Main email contact** hanswes@kth.se

Specific subject area(s)
Urban/regional planning

Title of project
Housing mobility and urban-social geography in metropolises today: a comparative study between Stockholm and Beijing

Number of available positions
1

Earliest start date
20 August 2020

Short description of the project
Post-urban development has triggered massive transformation in spatial and social-economic geography, bringing crisis in housing provision and social polarization in metropolitan cities today. This project aims at studying housing mobility (gentrification&filtering) processes, social-spatial relation and their transformation mechanisms in modern metropolises. A comparison between Stockholm and Beijing will be performed considering their similarity in high density urbanization and political background as capital cities.

Medical Image Analysis (Reg. No. 2002)

Type of position Full PhD study: 48 months		**Main supervisor** Chunliang Wang
KTH School CBH		**Co-supervisor(s)** Örjan Smedby
KTH Department Departement of Biomedical Engineering and Health Systems		**Main email contact** chunwan@kth.se

Specific subject area(s)
Artificial Intelligence for Medical image analysis

Title of project
Deep learning based image analysis method for studying cardiovascular diseases

Number of available positions
1

Earliest start date
August 2020

Short description of the project
Cardiovascular disease is the leading cause of death worldwide. Several large medical imaging studies have aimed at studying the risk factors, severity and prognosis of cardiovascular diseases using 3D imaging modalities such as CT, MRI, and ultrasound, which include the Swedish CArdioPulmonary bioImage Study (SCAPIS). While the early efforts and financial support have been focusing on the study design and imaging acquisition, it has become more and more evident that there is a lack of automated or semi-automated image analysis tool to perform quantitative analysis of the image data to allow researchers to better understand the disease pattern. Our research group is actively involved in developing advanced deep-learning-based image analysis tools to data-mine the big medical image databases and provide the clinicians with automated diagnosis tools. In this project, the PhD candidate will work closely with our clinical partners to develop advanced AI tools for diagnosis and evaluate cardiovascular disease and support big medical image data mining. The PhD candidate is expected to work with both advancing the deep learning theory to improve the accuracy and robustness of deep neural networks and translating the advanced image analysis methods to serve clinical practice. Good understanding of deep neural networks and good communication skills in English are required to apply for this position.

Medical Image Processing (Reg. No. 2003)

Type of position Full PhD study: 48 months		**Main supervisor** Örjan Smedby
KTH School CBH		**Co-supervisor(s)** Rodrigo Moreno
KTH Department Departement of Biomedical Engineering and Health Systems		**Main email contact** orsme@kth.se

Specific subject area(s)
Neurosurgery, cancer, Diffusion Magnetic Resonance Imaging (dMRI), tractography, deep learning.

Title of project
Deep learning-based tractography for tumor resection neurosurgery

Number of available positions
1

Earliest start date
August 2020

Short description of the project
Tractography is a method for inferring the most likely paths of neural fibers in the white matter (WM) of the brain from diffusion magnetic resonance imaging (dMRI) data. Tractography generates a set of streamlines that are usually referred to as tractograms. Visualizations of tractograms can be used in neurosurgery for preserving important neural bundles during brain tumor resection or for assessing infiltration of the tumor in WM [1]. Tractography can potentially be used both for surgery planning on images acquired preoperatively, or intraoperatively on images acquired during surgery. Despite its potential, tractography is not widely used intraoperatively. One of the reasons for this is that the current tractography methods generate many tracts that do not comply with the underlying anatomy [2]. Moreover, tractograms obtained preoperatively cannot be used directly during surgery, since the fiber bundle anatomy changes due to brain shift and the actual resection of tissue. Thus, such tractograms must be updated considering structural images acquired within the operating room (OR). This processing must be done efficiently as computational time is critical during surgery. Deep learning is a promising technique for dealing with these two problems: accuracy and efficiency. In the last few years, we have proposed methods based on deep learning for tractography [3,4]. Thus, the main task for the Ph.D. candidate is to improve our deep learning-based tractography tools in order to make them appropriate for both neurosurgery planning and the adaptation of tractograms for its use within the OR.

References
1. Costabile et al. Applications of Diffusion Tensor Imaging and Tractography in Intracranial Tumor Resection. Frontiers in oncology 9, 426 (2019)
2. Meier-Hein et al. The challenge of mapping the human connectome based on diffusion tractography. Nature Communications 8 (1), 1349 (2017)
3. Jörgens et al. Learning a single step of streamline tractography based on neural networks. Computational Diffusion MRI, 103-116 (2018)
4. Jörgens et al. Towards a deep learning model for diffusion-aware tractogram filtering. ISMRM Annual Meeting & Exhibition (2019)

Analytical Chemistry (Reg. No. 2004)

Type of position Full PhD study: 48 months		**Main supervisor** Gaston Crespo
KTH School CBH		**Co-supervisor(s)**
KTH Department Chemistry		**Main email contact** gacp@kth.se

Specific subject area(s)
Separation / Membranes / Electroanalysis

Title of project
Development of Universal Detector for Ion-Chromatography based on non-selective polymeric membranes

Number of available positions
1

Earliest start date
September 2020

Project website
https://crespo-groupkth.com

Short description of the project
Objective: Development of low cost IC detector based on non-polymeric membranes operated at zero current. Preliminary results have been obtained at the Crespo group using one class of non-polymeric PVC membranes. The Phd candidate will synthesise and characterise non-selective membranes. The most promising materials will be integrated in micro channel and couple to the IC column to be used as detector.

Fiber and Polymer Science (Reg. No. 2005)

Type of position Full PhD study: 48 months		**Main supervisor** Olena Sevastyanova
KTH School CBH		**Co-supervisor(s)** Mikael E. Lindström
KTH Department Fiber and Polymer Technology		**Main email contact** olena@kth.se

Specific subject area(s)
Wood Chemistry and Pulp Technology

Title of project
Lignin-based carbon materials for energy storage applications

Number of available positions
1

Earliest start date
1 February 2020

Short description of the project
Lignin, a major component of the lignocellulosic biomass, is generated in enormous amounts during pulp production. It is also a major coproduct of second generation biofuels. Effective utilization of lignin is critical for the accelerated development of advanced cellulosic biorefineries. Lignin as renewable, abundant, low cost, and high carbon content aromatics is an attractive precursor for the preparation of a range of carbon materials, including activated carbons, activated and structural carbon fibres, graphitic carbons or carbon black that could be used for environmental protection, as catalysts, in energy storage applications or as reinforcing components in advanced composite materials. For uses in electrochemical energy storage and conversion devices, properties such as excellent conductivity, ultra-large specific surface area, and special electronic structure are required. Such properties rely heavily on the structural characteristics of precursor for carbon materials; especially the fine microstructural control is largely dependent on the chemical composition, molecular structure and micromorphology of biomass precursors.

The goal of this project will be to develop an approach to diminish the molecular mass heterogeneity and structural diversity of lignin and further obtain a range of excellent carbon materials with highly promising practical energy storage application. This will include an analysis of lignin structure, development of various approaches to control molecular mass heterogeneity and morphology of lignin precursors and investigation of their thermal properties and pyrolysis behaviour. Such information is necessary to deeply understand the carbonization process of lignin/lignocellulosic precursors, so as to help us to simulate, design and improve a development of biomass-derived carbon materials with value-added properties for many practical applications.

Fiber and Polymer Science (Reg. No. 2006)

Type of position Full PhD study: 48 months		**Main supervisor** Olena Sevastyanova
KTH School CBH		**Co-supervisor(s)** Mikael E. Lindström
KTH Department Fiber and Polymer Technology		**Main email contact** olena@kth.se

Specific subject area(s)
Wood Chemistry and Pulp and Paper Technology

Title of project
Lignocellulose nanofibers (LCNFs): the impact of chemical composition of cellulosic materials on the nanofibrillation process, LCNF's properties and the performance in various materials.

Number of available positions
1

Earliest start date
1 March 2020

Short description of the project
The walls of plant cells, of which the lignocellulosic biomass consists, represent the most abundant renewable resource on the planet. The main constituents of the cell wall of lignocellulosic biomass, cellulose, hemicellulose and lignin, are strongly entangled and chemically bonded by non-covalent forces and by covalent cross-linkages, thus forming a unique natural structure. Both the botanical origin and the localization are the main factors that influence the composition of hemicellulose and lignin and the relative amount in the plant cell wall. The destruction of the cell wall of plant cells lead to a broad spectrum of new materials, such as cellulose nanoparticles (CNPs), cellulose nanofibers (CNFs), microfibrillated cellulose (MFC). Such cellulose-based materials have gained great interest over the last decade, since they constitute a biodegradable, renewable and naturally abundant resource with an important scientific and technological potential.

Although CNFs are usually obtained from delignified fibers, they can also be prepared from diverse non-delignified materials, obtaining CNFs with lignin, also called lignocellulose nanofibers (LCNFs). In recent years there is a growing interest have been observed for the production of LCNFs from various lignocellulosic raw materials due to the advantages such as high yield, low production cost, industrial adaptability and low environmental impact. In addition, the lignin content can be used to adjust the polarity and hydrophilicity of cellulose, allowing potentially new applications.

In this project we will investigate the impact of the lignocellulosic fibers origin, chemical composition and morphological characteristics on the production process of LCNF (nanofibrillation) and on the properties of the final product itself. Results obtained here will be an important contribution to the development of the production and application of nanocellulose with a controlled lignin content, expanding the spectrum of potential raw materials and the field of their applications.

Solid Mechanics; Mechanical Engineering (Reg. No. 2007)

Type of position Full PhD study: 48 months		**Main supervisor** Assist. Prof. Xiaogai Li
KTH School CBH		**Co-supervisor(s)** Dr. Peter Halldin; Prof. Svein Kleiven
KTH Department Chemistry, Biotechnology and Health (CBH)		**Main email contact** xiaogai@kth.se

Specific subject area(s)
Head injury biomechanics; Finite element modeling; Head protection systems.

Title of project
Mechanisms of head and neck injuries in children towards improved head protection systems

Number of available positions
1

Earliest start date
1 September 2020

Project website
https://www.kth.se/mth/neuronik/research

Short description of the project
Traumatic brain injury (TBIs) is a worldwide problem not only lead to substantial financial burden but also long-lasting consequences for the victims and close relatives. A better understanding of injury mechanisms is a necessary step towards developing novel and effective head protection systems to reduce the risks of brain injuries. Despite extensive research on adults, the injury biomechanics for children are less studied. Today, head protection for children are mostly scaled from adults. But children's heads cannot be taken as scaled small adults head due to nonlinear growth both in material property and geometrical. Further, different ages of children may injure differently. Thus, a better understanding the age-dependent head injury mechanisms are needed towards developing effective head protection systems (e.g., helmets) specifically for children, further, to optimize for different-ages of children. This project will be divided into two major parts: 1. Use advanced Human body models (HBMs) and head models of different details of children to study the age-dependent head injury mechanisms; 2. Develop & optimize novel head protection systems for different ages of children.
The research will be carried out at Division of Neuronic Engineering at KTH in collaboration with MIPS AB – an innovative head protection system company. The Division has a long tradition of performing multidisciplinary researches focusing on developing new and effective technology innovations for head and neck injury prevention as well as clinical treatment using advanced human head models. Since its establishment, several spin-off companies have been founded from the research conducted at the Division, e.g., MIPS AB, Impact Neuronic AB, Repair Technologies Sweden AB, Bioservo Technologies. The group also maintains thematically diverse international research collaborations and national industrial partners.
We are seeking a highly motivated and ambitious Ph.D. student for the above-outlined research project. The candidate is expected to have a solid background in solid mechanics. Experience in Finite Element (FE) modeling and computer programming are desirable, but not mandatory. The successful candidate will gain substantial experience in injury biomechanics, FE modeling, and innovative product design. The candidate will also be given solid technical support and supervision.

Biology (Reg. No. 2008)

Type of position Full PhD study: 48 months		**Main supervisor** Adil Mardinolgu
KTH School CBH		**Co-supervisor(s)**
KTH Department Protein Science		**Main email contact** adilm@kth.se

Specific subject area(s)
Head injury biomechanics; Finite element modeling; Head protection systems.

Title of project
Molecular diagnosis and stratification of stomach cancer for precision medicine using systems biology

Number of available positions
1

Earliest start date
1 April 2020

Short description of the project
Gastric cancer is the fifth most common cancer and the third most frequent cause of neoplasm-related deaths in the world, with over one million new cases and an estimated 783,000 deaths per year. In addition, gastric cancer patients usually have poor prognosis, with a reported five-year survival rate less than 10 percent. One of the main contributors to the poor survival of gastric cancer is the high metastasis rate at the time of diagnosis. In addition, stomach cancer is also very heterogeneous depending on the tumor location and the microenvironment in the stomach, which further hampers the treatment. Hence, understanding the early diagnosis and subtype stratification for stomach cancer is very important for the improvement of overall survival of stomach cancer patients. In this project, systems biology approaches are going to be used to stratify the subtypes of stomach cancers, investigate the key biological pathways that specific to each of the subtype, and identify drug targets that could be potentially used to treat each of the subtype. In addition, we will also explore the possibility of repurpose existing small molecule drugs for, either for the majority or a subgroup of, stomach cancer treatment based on their molecular signature. This project's main aim is to find novel and practical biomarkers for diagnosis of different subtypes of stomach cancers, and identify subtype specific drug targets and novel treatment strategies for them.

Computer Science (Reg. No. 2009)

Type of position Full PhD study: 48 months		**Main supervisor** Sten Ternström
KTH School EECS		**Co-supervisor(s)** Bob Sturm
KTH Department Intelligent Systems: Speech, Music and Hearing		**Main email contact** stern@kth.se

Specific subject area(s)
Speech and Music Communication

Title of project
Deriving models of articulatory phonetics from large voice datasets

Number of available positions
1

Earliest start date
August 2020

Short description of the project
The human voice is a very complicated transducer and its quantitative characterization poses many challenges. Although high-order Finite Element Modeling is a current trend, low-order models based on biomechanics would have greater explanatory power in a clinical or pedagogical setting. This project is about applying recent statistical techniques to large datasets of voice in order to formulate more insightful models of human voice production.

Security and privacy (Reg. No. 2011)

Type of position Full PhD study: 48 months		**Main supervisor** P. Papadimitratos
KTH School EECS		**Co-supervisor(s)**
KTH Department Computer Science / Communication Systems		**Main email contact** papadim@kth.se

Specific subject area(s)
Network security, wireless security, mobile security and privacy, Internet security and privacy

Title of project
Trustworthy Internet of Things

Number of available positions
Up to 3

Earliest start date
1 March 2020

Project website
http://www.eecs.kth.se/nss

Short description of the project
The NSS group designs and builds trustworthy networked systems. Our research agenda covers a gamut of security and privacy problems a number of our results got significant attention by the researchThe NSS group designs and builds trustworthy networked systems. Our research agenda covers a gamut of security and privacy problems a number of our results got significant attention by the research community. Our teaching efforts lead to a new security curriculum we introduced at KTH.Candidates with experimental/systems or theoretical profiles and research interests in any aspect of security and privacy are welcome to apply.Applicants must hold or be about to receive an MSc degree in computer science, electrical engineering, computer engineering, information and communication technologies, or a related area. Furthermore, the applicant must have:* Strong academic credentials, written and spoken English proficiency, communication and team-work skills.* Interest in several of the following: design, analysis, verification, implementation, or empirical evaluation of secure networked systems.* Background in several of the following: computer security, mobile computing, networking, Internet security, wireless communications, distributed algorithms and systems, programming languages, performance analysis, operating systems, simulation techniques and tools, software engineering, system and network programming, applied cryptography, privacy preserving or enhancing technologies, optimization, information theory.* Preparation and readiness to contribute to our research agenda and to work in an internationally oriented group. community. Our teaching efforts lead to a new security curriculum we introduced at KTH.

Machine Design (Reg. No. 2012)

Type of position Full PhD study: 48 months		**Main supervisor** Sergei Glavatskih
KTH School ITM		**Co-supervisor(s)** Thomas Norrby
KTH Department Machine Design		**Main email contact** segla@kth.se

Specific subject area(s)
Machine Design

Title of project
Lubricant design for e-drives

Number of available positions
1

Earliest start date
1 June 2020

Short description of the project
The research project aims at the development of new lubrication technologies to enhance e-mobility. The demands on lubricants for increased energy efficiency and sustainability in “green” electric machinery are escalating. The goal of the project is to understand lubrication mechanisms of novel lubricant formulations to control friction and decrease wear. The technology can also bring additional functionality such as electric conductivity.
Lubricated contacts of gears and bearings will be modelled and studied by using our research facilities. A range of equipment will be used to analyze surfaces and lubricant properties. The research is part of a multidisciplinary project, which will link synthesis, simulations, physical chemistry and tribology. This project is carried out in a close collaboration with industry.

Embedded Control Systems (Reg. No. 2013)

Type of position Full PhD study: 48 months		**Main supervisor** Dejiu CHEN
KTH School ITM		**Co-supervisor(s)**
KTH Department Institute of Machine Design		**Main email contact** chen@md.kth.se

Specific subject area(s)
Embedded Control Systems (ECS) represent a class of computer and electronic systems that constitute the core of next generation Cyber-Physical Systems (CPS)

Title of project
Self-Managed AI Centric Cyber-Physical Systems

Number of available positions
1-2

Earliest start date
March 2020

Short description of the project
This research addresses the operational management for advanced CPS consisting of AI algorithms and specific hardware technologies. The ultimate goal is to support automated monitoring and assessment of AI services and components in regard to overall system performance and safety, given the presences of emergent conditions and anomalies in system operation. The research is necessitated by the fact that conventional measures for quality assurance (e.g. formal methods, simulation and testing) become insufficient for CPS having high degrees of operational flexibility and deeply intertwined heterogeneous cyber and physical aspects. The work will be focused on the further development of a model-based approach to self-management services for AI centric CPS, with next generation automotive AI platforms as targets. The approach will in particular leverage the state-of-the art technologies for a rich system description with multi-viewed models, simulation and formal analysis to achieve effective requirements engineering and synthesis of runtime services for operation monitoring, diagnostics and quality-of-service adaptations. The research will draw on the latest progress and contribute to the advances in multiple fields of embedded control systems, including model-based system development (MBD), safety engineering, AI and robotics.

Functional Materials (Reg. No. 2014)

Type of position Full PhD study: 48 months		**Main supervisor** Joydeep Dutta
KTH School SCI		**Co-supervisor(s)** Fei Ye
KTH Department Applied Physics		**Main email contact** joydeep@kth.se

Specific subject area(s)
Advanced functional coatings

Title of project
Anticorrosion coatings using sustainable biopolymers suitable for the circular economy

Number of available positions
1

Earliest start date
1 July 2020

Project website
https://www.aphys.kth.se/groups/mnp/research-groups/functional-materials/functional-nano-materials-fnm-1.293276

Short description of the project
The goal of this project is to develop low-cost, sustainable, non-toxic and environmentally-friendly anticorrosive coatings on surfaces based on biopolymers suitable for a circular economy.

Biophysics (Reg. No. 2015)

Type of position Full PhD study: 48 months		**Main supervisor** Lucie Delemotte
KTH School SCI		**Co-supervisor(s)**
KTH Department Applied Physics		**Main email contact** lucie.delemotte@scilifelab.se

Specific subject area(s)
Molecular dynamics of membrane proteins

Title of project
Combining molecular dynamics simulations and machine learning for conformational sampling of biomolecules

Number of available positions
1

Earliest start date
As soon as possible

Project website
https://www.biophysics.se/index.php/projects/delemottelab/enhanced-sampling/

Short description of the project
The field of conformational sampling of biomolecules is being revolutionized by machine learning techniques. In this project we propose to develop methods to combine enhanced sampling molecular dynamics methods with generative models from machine learning. Applications include activation of membrane proteins such as GPCRs and ion channels.

Engineering Mechanics (Reg. No. 2016)

Type of position Full PhD study: 48 months		**Main supervisor** Lanie Gutierrez-Farewik
KTH School SCI		**Co-supervisor(s)** Ruoli Wang
KTH Department Engineering Mechanic		**Main email contact** lanie@kth.se

Specific subject area(s)
Biomechanics, human movement mechanics, exoskeleton design, human strength augmentation

Title of project
Design, simulation, control and sensors in active exoskeletons and assistive devices for patients with motor disorders

Number of available positions
1-2

Earliest start date
1 September 2020

Project website
https://www.kth.se/en/sci/kth-moveability-lab

Short description of the project
KTH MoveAbility Lab, at the Department of Engineering Mechanics, is offering a PhD student position in Biomechanics, with a focus on assistive devices that augment motion in patients with motor disorders. People with disabilities are the largest minority group in the world. Despite this, we as scientists have relatively little ability to prevent the long-term downward spiral which occurs when their primary disability causes secondary consequences on the body. This PhD project aims to design and develop robotic assistive devices for the lower extremities that complement one's physical function and give one the opportunity to locomote and perform daily activities optimally according to one's abilities. These can be comprised of hard materials, with or without a combination with soft, compliant materials. The doctoral student shall, through simulation-based design and prototyping, develop devices that sense and provide assistance-as-needed that complements the user's own abilities, within a closed loop that includes the user's biosignals. The devices should take advantage of users' inherent capabilities, yet still reduce the users' metabolic energy demands and increase their ability to perform daily activities.The project focus could include any or all of the following methodologies, among others: detection and identification of motion intention using wearable biosensors, recognition of motion phases, simulation-based biomechanical modelling of the person-device system, hybrid device control which balances inputs based on the user's muscle activation signals with automatic control, intrinsic or extrinsic device control, human-in-the-loop optimization. Specific methods can include simulation, motion prediction using biomechanical modelling, motion prediction using machine learning algorithms, prototyping, and experimentation on human subjects. The project will be partially financed through the Promobilia Foundation. The target group includes individuals with physical disabilities due to pathology, injury or age.

Applied Physics (Reg. No. 2017)

Type of position Full PhD study: 48 months		**Main supervisor** Prof. Anna Delin
KTH School SCI		**Co-supervisor(s)** Prof. Olle Eriksson (Uppsala University) and Prof. Erik Sjöqvist (Uppsala University)
KTH Department Applied Physics		**Main email contact** annadel@kth.se

Specific subject area(s)
Computational physics

Title of project
Developing and using new simulation tools for magnetic materials

Number of available positions
1

Earliest start date
1 October 2020

Project website
https://www.kth.se/profile/annadel/page/csc-phd-projects-with-start-in-2020

Short description of the project
Development of computational tools for spin-lattice simulations with first-principles accuracy. The work enables understanding ultra-fast dynamics, transfer of angular momentum in materials, and spincaloritronics.

Photonics (Reg. No. 2018)

Type of position Full PhD study: 48 months		**Main supervisor** Max Yan
KTH School SCI		**Co-supervisor(s)** Kristinn Gylfason
KTH Department Department of Applied Physics		**Main email contact** miya@kth.se

Specific subject area(s)
Mid-infrared, silicon photonics, thermal emission, metamaterial, gas sensor

Title of project
Integrated Mid-Infrared Photonics

Number of available positions
1

Earliest start date
1 September 2020

Project website
https://www.kth.se/profile/miya

Short description of the project
Controlling infrared (IR) light has critical importance not only that IR radiation fundamentally regulates thermal energy flow in our environment but also that IR radiation enables augmented technologies in security monitoring, gas sensing, and life science. In this project we investigate critical integration techniques for mid-infrared (MIR, 3-8 μm) radiation on silicon platform towards mainly gas sensing application. Key components include thermal-emission based MIR sources, low-loss MIR waveguides, and even on-chip IR detection techniques. Knowledge to be developed/used: electromagnetic simulation, spectrally selective thermal emitter design, nanofabrication, infrared thermography, FTIR spectroscopy, system integration for gas sensing, etc. This is a collaboration project between Photonics unit (School of Engineering Sciences) and Micro and Nanosystems (School of Electrical Engineering and Computer Science), both at KTH.

Biomechanics/ Engineering Mechanics (Reg. No. 2019)

Type of position Full PhD study: 48 months		**Main supervisor** Ruoli Wang
KTH School SCI		**Co-supervisor(s)** Lanie Gutierrez-Farewik
KTH Department Engineering Mechanic		**Main email contact** ruoli@kth.se

Specific subject area(s)
biomechanics, 2D/3D ultrasound, muscle electromyography, musculoskeletal modeling, human movement

Title of project
Integration of HD-EMG, 2D/3D ultrasound and musculoskeletal modeling for the assessment of *in vivo* neurophysiology and mechanical function coupling of human muscles

Number of available positions
1

Earliest start date
September 2020

Project website
https://www.kth.se/en/sci/kth-moveability-lab

Short description of the project
Up to 1 billion people worldwide suffer from various neurological disorders. Impaired motor function is one of the major results of a malfunctioning nervous system, wherein patients may lose their ability to perform daily activities. The neurological originated disorders are often accompanied with the secondary, non-neurological impairments in muscle tissues. Human musculoskeletal function is accomplished via neural control of muscle contractions that generate interaction forces throughout the skeletal system. Conventionally, muscle activation and the muscle tissue structure are investigated using surface electromyography (EMG) and ultrasound (US), respectively. Surface EMG, especially high-density surface EMG (HD-EMG) provides a high spatio-temporal resolution of the muscle electrophysiological events during the movement. 2D US samples images allows quantifying muscle structure parameters and displacement during muscle contractions. 3D US can overcome the limited view of a 2D US transducer by adding a pose sensor to the US transducers, which results in a volumetric data set of the muscle anatomy. Combining HD-EMG and 2D/3D US has the great potential to provide a detailed description of muscle function, from the neural excitation to the resulting muscle tissue structure and force production capacity. This innovative approach can contribute to the investigation of muscle physiology, to inform personalized musculoskeletal model, to facilitate human-machine design and to the assessment of rehabilitation interventions. The applicant will be expected to be involved in experimental methodology development, data collection, and computationally simulations. Experience with medical imaging and biological signal post-processing are required. Basic knowledge about biomechanics of human movement is desired.

Photonics (Reg. No. 2020)

Type of position Full PhD study: 48 months		**Main supervisor** Max Yan
KTH School SCI		**Co-supervisor(s)** Valdas Pasiskevicius
KTH Department Department of Applied Physics		**Main email contact** miya@kth.se

Specific subject area(s)
Electromagnetic waveguide, metamaterial, terahertz technology

Number of available positions
1

Title of project
Microstructured Terahertz Fiber

Earliest start date
1 September 2020

Project website
https://www.kth.se/profile/miya

Short description of the project
Terahertz radiation (0.1-1 mm in wavelength) can penetrate common materials including skin, clothing, cardboard, plastic, etc. Therefore, besides high-speed free-space optical communication, terahertz waves are extremely attractive for medical imaging, material characterization, and security monitoring etc. Recently, much has happened on development of new terahertz sources. One of the leading groups is Laser Physics in KTH. However, guiding terahertz waves in a flexible way like what we do for traditional telecom light (1.5 um) is still a challenge, mainly because of relatively strong material absorption. Hollow-core terahertz fiber has been created with thin metal coating on its inner surface, but such a fiber is not flexible. The purpose of this project is to develop metamaterial-based terahertz fiber with potentially a propagation loss below 1 dB/m. The candidate is expected to take up challenges in electromagnetic simulation, micro-fabrication, and propagation-loss characterization of fabricated fibers.

Nuclear Power Safety (Reg. No. 2021)

Type of position Full PhD study: 48 months		**Main supervisor** Weimin Na
KTH School SCI		**Co-supervisor(s)** Sevostian Bechta
KTH Department Physics		**Main email contact** weimin@kth.se

Specific subject area(s)
Development of methods and models for deterministic and probabilistic safety analysis, experimental studies and multiscale modeling of the relevant physical phenomena.

Number of available positions
1

Title of project
Modelling and Simulation of Corium Melt and Debris Spreading Under Water

Earliest start date
1 September 2020

Short description of the project
The proposed work is concerned with modelling and simulation of corium melt and debris spreading under water, which are important to the assessment of ex-vessel corium risk and to the qualification of melt retention strategy during severe accidents of light water reactors (LWRs). The idea behind this project is to take advantage of the experimental database to be obtained in the ongoing OECD project ROSAU, and develop new physical models so that numerical simulation tools can be validated against relevant data and finally used for reactor safety analysis. The project will leverage on the results of previous investigations on melt and debris underwater spreading which were carried out at KTH during past years.

Applied and Computational Mathmatics (Reg. No. 2022)

Type of position Full PhD study: 48 months		**Main supervisor** Xiaoming Hu
KTH School SCI		**Co-supervisor(s)**
KTH Department Mathematics		**Main email contact** hu@kth.se

Specific subject area(s)
Optimization and Systems Theory

Title of project
Multi-agent systems and distributed artificial intelligence

Number of available positions
2

Earliest start date
1 August 2020

Short description of the project
The synergy of multi-agent systems (MAS) is based on interaction among individual agents, leading to the formation of artificial groups and communities. Depending on the number of interacting agents and the inherent characteristics of their interactions, various directions of development and types of MAS can be distinguished.
The studies of interaction and cooperation of a small number of intelligent agents, for example, the classical intelligent systems, including knowledge bases and solvers, compose the kernel of Distributed Artificial Intelligence (DAI). In other words, group intellectual behavior in DAI is based on individual intellectual behaviors. This means a congruence of the objectives, interests and strategies of different agents, coordination of their actions, and the resolution of conflicts through negotiations. In many scenarios, agents in a MAS model can act cooperatively, competitively or exhibit neutral behaviors. To handle those complexities, it is very useful to borrow ideas from non-cooperative game theory in which emergence of the MAS can be tightly connected to a Nash equilibrium. Some other approaches draw benefit from the joint use of MAS and Machine learning (ML), since ML can use agent-based model (ABM) as the environment and the reward generator while ABM can use ML to refine the internal models of the agents. The neural networks are therefore used as a computational approximation of the nonlinear dynamical system generated by the ABM, or generally as computational emulators of entire ABMs.
In this project we will further develop these existing approaches and integrate them with graphic models and mean field games. With the incorporation of graphic models we will study how interaction topology will shape the emergence; Mean field games, on the other hand, will facilitate not only the interaction between individual agents but also track the decision-making process in huge groups of agents.

Physics (Reg. No. 2023)

Type of position Full PhD study: 48 months		**Main supervisor** Prof. Anna Delin
KTH School SCI		**Co-supervisor(s)** Prof. Olle Eriksson (Uppsala University) and Prof. Erik Sjöqvist (Uppsala University)
KTH Department Applied Physics		**Main email contact** annadel@kth.se

Specific subject area(s)
Condensed matter physics

Title of project
Theory of topological magnetic states in materials

Number of available positions
1

Earliest start date
1 October 2020

Project website
https://www.kth.se/profile/annadel/page/csc-phd-projects-with-start-in-2020

Short description of the project
Magnetic states (e.g. skyrmions) with non-trivial topology will be investigated using both analytical theory and state-of-the art computational tools (spin dynamics, data mining, machine learning).

Physics (Reg. No. 2024)

Type of position Full PhD study: 48 months		**Main supervisor** Prof. Anna Delin
KTH School SCI		**Co-supervisor(s)** Prof. Olle Eriksson (Uppsala University) and Prof. Erik Sjöqvist (Uppsala University)
KTH Department Applied Physics		**Main email contact** annadel@kth.se

Specific subject area(s)
Condensed matter physics

Title of project
Topological Crystals of Time

Number of available positions
1

Earliest start date
1 October 2020

Project website
https://www.kth.se/profile/annadel/page/csc-phd-projects-with-start-in-2020

Short description of the project
In this project, the aim is to investigate if the recently proposed quantum time crystal can be realized using collective magnetic modes with unique topology.

Physics (Reg. No. 2025)

Type of position Full PhD study: 48 months		**Main supervisor** Jonas Weissernieder
KTH School SCI		**Co-supervisor(s)** Oscar Tjernberg
KTH Department Applied Physics		**Main email contact** jonas@kth.se

Specific subject area(s)
ultrafast dynamics in correlated materials

Title of project
Ultrafast Dynamics in Quantum Materials

Number of available positions
1-2

Earliest start date
September 2020

Project website
https://www.aphys.kth.se/groups/mnp/research-groups/ultrafast-electron-m

Short description of the project
In the position you are expected to conduct experimental research at the unit of Material and Nano Physics. Central to the research project is the study of phenomena and processes that occur at extremely short time periods, down to the femtosecond time scale (10^-15 s). In your research, you will be part of a strong research group studying ultrafast transient states and phase transitions of quantum materials as well as ultrafast dynamics in magnetic systems. Your research will be focused on a newly commissioned and for Sweden unique instrument for ultrafast electron diffraction and microscopy, an ultrafast electron microscope (UEM). The instrument is based on modified technology from the fields of transmission electron microscopy and femtosecond pulsed lasers. When merged these fields enables development of a microscope that can track the position of atoms with a time resolution of a few hundred femtoseconds, facilitating the recording of "movies" that follows the motion of atoms within a material through a change in state. This new microscope will thus provide information on structural dynamic processes that previously was not feasible to study experimentally. The PhD project will be conducted in close collaboration with researchers (Postdocs and other PhD:s) studying similar material systems with time and angle resolved photoemission (trARPES)in order to obtain electronic band structure information. When results from UEM and trARPES are merged we may formulate a complete picture of the dynamics in quantum materials. Your research will include nonlinear optics, transmission electron microscopy, electron diffraction, and electron energy loss spectroscopy.

Guest doctoral study: 6-24 months (no degree awarded)

Electromagnetic Engineering (Reg. No. 2010)

Type of position Guest doctoral study: 24 months		**Main supervisor** Oscar Quevedo-Teruel
KTH School EECS		**Co-supervisor(s)**
KTH Department EME		**Main email contact** oscarqt@kth.se

Specific subject area(s)
Antennas, microwaves, metamaterials, metasurfaces

Title of project
Glide symmetries and lens antennas

Number of available positions
1
Earliest start date
1 June 2020

Exact duration of the position
24 months

Project website
http://www.etk.ee.kth.se/personal/oscarqt/

Short description of the project
Goal:
The main goal of this project is to investigate the concept of higher symmetries and geodesic lenses for generating highly efficient antenna systems at the mm-wave frequencies. Therefore, to produce high efficient systems, fully-metallic integrated antenna solutions will be investigated.
Qualifications:
The candidate should have a strong background from at least one of the areas: metamaterials, metasurfaces, electromagnetic bandgaps, leaky wave antennas, lens antennas, or higher symmetries.
The successful applicant should have an outstanding research and publication record. Well-developed analytical and problem solving skills are a requirement.
We are looking for a strongly motivated person, who is able to work independently. Good command of English orally and in writing is required to present and publish research results, as well as, to conduct meetings with industrial partners.
Location:
The work will be developed in the central campus of KTH, at the Division of Electromagnetic Engineering (EME, https://www.kth.se/eme), in the School of Electrical Engineering and Computer Science (EECS, https://www.kth.se/en/eecs/). The staff has a multicultural background and the working language is English. The department is internationally well established, has many research collaborations with excellent partners worldwide, and is involved in several European and national projects.
The main advisor will be O. Quevedo-Teruel. Information about his research activities can be found in:
http://www.etk.ee.kth.se/personal/oscarqt/

Geoinformatics (Reg. No. 2026)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Yifang Ban
KTH School ABE		**Co-supervisor(s)**
KTH Department Urban Planning and Environment		**Main email contact** yifang@kth.se

Specific subject area(s)
Remote Sensing, Deep Learning, Change Detection

Title of project
Earth Observation Big Data and Deep Learning for Global Environmental Change Monitoring

Number of available positions
2

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
Our planet is facing unprecedented environmental challenges including rapid urbanization, deforestation, pollution, loss of biodiversity, rising sea-level, melting glacier and climate change. During recent years, the world also witnessed natural disasters striking across the globe, from droughts, heat waves and wildfires to flooding, hurricanes and earthquakes, killing thousands and inflicting billions of dollars in property and infrastructural damages. With its synoptic view, large area coverage at regular revisits, satellite remote sensing offers a powerful and effective means to observe disaster damages and monitor environmental changes at local, regional and global scale. The overall objective of this research is to develop innovative and robust methods for environmental change detection and environmental impact assessment using Earth Observation big data and a deep learning framework, focusing on monitoring urbanization, forest fires, and melting glaciers.

Steel Structures Subjected to Fire (Reg. No. 2027)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Jean-Marc Battini
KTH School ABE		**Co-supervisor(s)**
KTH Department Byggetenskap		**Main email contact** jean-marc.battini@byv.kth.se

Specific subject area(s)
Numerical buckling analyses of steel columns subjected to fire

Title of project
Numerical analyses of cold-formed steel built-up box section columns subjected to fire

Number of available positions
1

Earliest start date
1 July 2020

Exact duration of the position
12 months

Short description of the project
The purpose of the project is to perform advanced numerical analyses on cold-formed steel built-up box section columns subjected to fire by using the program Abaqus. Both heat transfer and structural analyses will be performed.

The first objective is to calibrate and validate the numerical analyses by using experimental results.

The second objective is to perform parametric studies and based on the obtained results to propose a design method.

Food Waste Valorization (Reg. No. 2028)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Yves Hsieh
KTH School CBH		**Co-supervisor(s)**
KTH Department Department of Chemistry		**Main email contact** yvhsieh@kth.se

Specific subject area(s)
Carbohydrate Engineering, Green Chemistry

Title of project
Application of Lytic Polysaccharide Monooxygenase (LPMO) in Food Waste Bioconversion

Number of available positions
1

Earliest start date
February 2020

Exact duration of the position
6 months

Short description of the project
EU food industry produced large volumes of organic wastes, with associated costs estimated at 143 billion euros. Majority of rejected wastes are produced during the manufacturing the processed foods and beverages. Increase in production capacity to meet the global demand will inevitably lead to increasing pollution that detriment the environment. This has inspired us to develop sustainable, clean technologies based on the use of enzymes from the recently discovered Lytic Polysaccharide Monooxygenases (LPMOs) class, to produce biofuels or biomaterials from rejected food wastes.

The LPMOs have recently discovered the class of enzymes that assist the degradation of recalcitrant polysaccharides by glycoside hydrolase through oxidizing activities. Several recently identified LPMOs are able to catalyze the oxidative cleave in chitin, cellulose, hemicelluloses, and starch. These enzymes have attracted considerable attention owing to their potential use in biomass deconstruction for the production of biofuel. The project aims to develop an efficient processing method using newly discovered enzymes from two LPMO family: the AA10 and AA14, that (i) facilitate the breakdown of the resilient cellulosic and xylan fibers from the rejected wastes include fruit peels, pulps, seeds scraps from juice production, spent grains from beer production, grape marc discarded from wine production, and rice (or wheat) straws into fermentable sugars, (ii) to introduce reactive functional groups on the surface of cellulose and xylan fibers for the production of biodegradable carbohydrate-based biomaterials.

The project involves implement techniques of enzyme expression and purification, enzymology, biomass fermentation, saccharification, and material chemistry. Concomitantly, training of new skills related to carbohydrate analytical chemistry, bioconjugation chemistry, and in-house high-throughput enzyme activity screening assays will be provided by the host laboratory.

Food Waste Valorization (Reg. No. 2029)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Yves Hsieh
KTH School CBH		**Co-supervisor(s)**
KTH Department Department of Chemistry		**Main email contact** yvhsieh@kth.se

Specific subject area(s)
Carbohydrate Engineering, Green Chemistry

Title of project
Application of Lytic Polysaccharide Monooxygenase (LPMO) in Food Waste Bioconversion

Number of available positions
1

Earliest start date
1 January 2020

Exact duration of the position
12 months

Short description of the project
EU food industry produced large volumes of organic wastes, with associated costs estimated at 143 billion euros. Majority of rejected wastes are produced during the manufacturing the processed foods and beverages. Increase in production capacity to meet the global demand will inevitably lead to increasing pollution that detriment the environment. This has inspired us to develop sustainable, clean technologies based on the use of enzymes from the recently discovered Lytic Polysaccharide Monooxygenases (LPMOs) class, to produce biofuels or biomaterials from rejected food wastes.

The LPMOs have recently discovered the class of enzymes that assist the degradation of recalcitrant polysaccharides by glycoside hydrolase through oxidizing activities. Several recently identified LPMOs are able to catalyze the oxidative cleave in chitin, cellulose, hemicelluloses, and starch. These enzymes have attracted considerable attention owing to their potential use in biomass deconstruction for the production of biofuel. The project aims to develop an efficient processing method using newly discovered enzymes from two LPMO family: the AA10 and AA14, that (i) facilitate the breakdown of the resilient cellulosic and xylan fibers from the rejected wastes include fruit peels, pulps, seeds scraps from juice production, spent grains from beer production, grape marc discarded from wine production, and rice (or wheat) straws into fermentable sugars, (ii) to introduce reactive functional groups on the surface of cellulose and xylan fibers for the production of biodegradable carbohydrate-based biomaterials.

The project involves implement techniques of enzyme expression and purification, enzymology, biomass fermentation, saccharification, and material chemistry. Concomitantly, training of new skills related to carbohydrate analytical chemistry, bioconjugation chemistry, and in-house high-throughput enzyme activity screening assays will be provided by the host laboratory.

Chemistry and Biology (Reg. No. 2030)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Yaoquan Tu
KTH School CBH		**Co-supervisor(s)**
KTH Department Theoretical Chemistry and Biology		**Main email contact** yaoquan@kth.se

Specific subject area(s)
Theoretical Chemistry and Biology

Title of project
Computational studies of protein-ligand interactions

Number of available positions
2

Earliest start date
1 September 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/profile/yaoquan/page/research

Short description of the project
The knowledge of protein-ligand interactions is essential for structure-based drug design and understanding of many biological processes. With the development of computer technologies, theoretical modelling has become an increasing powerful tool in the study of protein-ligand binding. In this project, we will use new modeling methods to the studies of protein-ligand interactions, elucidate the mechanism of protein-ligand interactions, and explore new opportunities in drug design.

Medical Image Analysis (Reg. No. 2031)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Chunliang Wang
KTH School CBH		**Co-supervisor(s)**
KTH Department Department of Biomedical Engineering and Health Systems		**Main email contact** chunwan@kth.se

Specific subject area(s)
Artificial Intelligence for Medical image analysis

Title of project
Deep learning based image analysis method for studying cardiovascular diseases

Number of available positions
1

Earliest start date
August 2020

Exact duration of the position
10-12 months

Short description of the project
Cardiovascular disease is the leading cause of death worldwide. Several large medical imaging studies have aimed at studying the risk factors, severity and prognosis of cardiovascular diseases using 3D imaging modalities such as CT, MRI, and ultrasound, which include the Swedish CArdioPulmonary bioImage Study (SCAPIS). While the early efforts and financial support have been focusing on the study design and imaging acquisition, it has become more and more evident that there is a lack of automated or semi-automated image analysis tool to perform quantitative analysis of the image data to allow researchers to better understand the disease pattern. Our research group is actively involved in developing advanced deep-learning-based image analysis tools to data-mine the big medical image databases and provide the clinicians with automated diagnosis tools. In this project, the guest doctoral student will work closely with our clinical partners to develop advanced AI tools for diagnosis and evaluate cardiovascular disease and support big medical image data mining. The guest doctoral student is expected to work with the supervisors to implement state-of-art deep learning methods and translate the advanced image analysis methods to easy-to-use software for clinical applications.

Evolutionary Genetics and Genomics (Reg. No. 2032)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Peter Savolainen
KTH School CBH		**Co-supervisor(s)** Pelin Sahlen
KTH Department Department of Gene Technology		**Main email contact** savo@kth.se

Specific subject area(s)
Identification of regulatory sequences and genes under selection in the domestication, by mapping of promoters and enhancers, and genome sequencing. Phylogeographic analyses.

Title of project
Evolution of the dog: identification of genes selected at the domestication and the geographic origin

Number of available positions
1

Earliest start date
1 June 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/gte/evolutionary-biology-and-forensics-1.783359

Short description of the project
This project is based on a long-established collaboration between Sweden and China, with the research group of Professor Ya-ping Zhang at Kunming Institute of Zoology, Chinese Academy of Sciences. In a number of prominent papers we have previously, based on large-scale genetics and genomics, indicated South China as the probable region of dog origins, and identified genes under selection in the first phase of dog evolution, affecting e.g. digestion and behaviour.

Previous studies were based on genome sequencing, which can identify only roughly 50% of the affected genes, since most mutations are situated in regulating regions far from the affected genes. We will now perform more precise studies to identify regulatory sequences and genes under selection in the domestication, by mapping of promoters and enhancers and their interactions, and genome sequencing.

We will also analyse all types of genetic markers: nuclear genomes as well as mitochondrial, Y-chromosomal and X-chromosomal DNA, for refined phylogeographic analyses.

Because of the broad aims of this study, students with different backgrounds are welcome to apply; molecular biology, bioinformatics or phylogeographic analysis.

Biomedical Engineering (Reg. No. 2033)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Dmitry Grishenkov
KTH School CBH		**Co-supervisor(s)** Anna Hanner
KTH Department Biomedical Engineering and Health Systems		**Main email contact** dmitryg@kth.se

Specific subject area(s)
Ultrasound; drug delivery

Title of project
Nano-engineered capsules for improved ultrasound imaging and controlled drug delivery.

Number of available positions
2

Earliest start date
1 January 2020
Exact duration of the position
12 months

Project website
https://www.kth.se/profile/dmitryg/page/projects

Short description of the project
Coated perfluorocarbon-loaded capsules based on cellulose nanofibers (CNF) in combination with drugs can be used for controlled and targeted drug delivery or following acoustic droplet evaporation as a contrast agent in pharmaceutical and biomedical applications.
The objective of the project is to further improve existing and develop new contrast pulse sequences for diagnostic and therapy using the preclinical ultrasound imaging platform Verasonics, acquired through the Jonassons Centre for Medical Imaging.

In additional mathematical modelling of acoustic wave propagation through complex media including situation with the phase changing (Acoustic droplet evaporation) is of particular interest.

Tasks and responsibilities includes but not limited to:
1. Development and design new contrast pulse sequences using single crystal set-up and extend this knowledge towards programmable ultrasound system Verasonics.
2. Matematical modelling of wave propagating
3. Experimental work on acoustic droplet evaporation using the developed sequences.
4. Tissue mimicking phantom fabrication
5. Design of the new experimental sep-up for demonstration of complex acoustic phenomenon.

Polymer Technology (Reg. No. 2034)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Minna Hakkarainen
KTH School CBH		**Co-supervisor(s)** Karin Odelius
KTH Department Fibre and Polymer Technology		**Main email contact** minna@kth.se

Specific subject area(s)
Polymer Technology

Title of project
Recyclable thermosets from renewable resources

Number of available positions
1

Earliest start date
1 September 2020
Exact duration of the position
12 months

Project website
https://www.kth.se/fpt/polymer-technology

Short description of the project
There is today an increasing awareness of the growing issues connected to our current production, use and recovery of plastic materials. Numerous reasons for converting to a circular bioeconomy are put forward and include the depletion of fossil resources and greenhouse gas emissions connected to their use, the environmental effect of our methods and techniques for producing plastic materials and the obvious increasing amount of plastic waste and the limited options and available infrastructure to handle it. One material group for which the end-of-life handling is especially challenging is the thermosets. These network structure are commonly intended for high demand applications and are not re-shapeable upon heating, contrary to the more commonly used thermoplastics. This project is therefore intended to tackle several of these issues in an attempt to move towards a more sustainable plastic production, use and end-of-life handling. First, approaches for using renewable resources and applying the principles of green chemistry in the synthesis of thermosets will be elucidated. The chemical structure of the renewable building-blocks will be carefully chosen to ensure that the material property demands and lifespan of the material set for the specific application are met. The thermoset will also need to be designed to enable thermoset recycling after use. Secondly, benign recycling conditions will be elucidated for the thermoset to ensure full material recovery and to enable new material synthesis of the created building-blocks. Recyclable thermosets from renewable resources with the desired structure-property relationship will be achieved and contribute to a future circular bioeconomy.

Optimization and Machine Learning (Reg. No. 2035)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** György Dán
KTH School EECS		**Co-supervisor(s)** James Gross
KTH Department Computer Science		**Main email contact** gyuri@kth.se

Specific subject area(s)
Distributed systems, resource management

Title of project
Trustworthy resource management for edge computing

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
Edge computing is emerging as a computing paradigm that will enable a variety of cyber physical system (CPS) applications in future mobile networks, through low latency access to distributed computing resources. Combined with adaptive resource management based on principles inspired by recent advances in machine learning, edge computing could be also a cost efficient approach for relieving networks from significant IoT traffic. Nonetheless, in order for CPS and IoT applications to be able to rely on edge computing, edge computing has to provide predictable performance despite the openness of edge computing systems, the usage of off-the-shelf components as well as the shared nature of the edge infrastructure.

The objective of this project is to develop algorithms and fundamental engineering principles for making resource management in edge computing system predictable. Starting from a stochastic characterization of wireless technologies and computing platforms, we will develop a methodology for providing predictions of end-to-end latency based on principles of hierarchical machine learning models. Results obtained for single edge deployments will then be generalized to capture the interaction between edge computing systems and centralized clouds, focusing on resource allocation and placement. Finally, the predictability of the communication and computing infrastructure will be jointly optimized with application capabilities, so as to ensure predictable CPS and IoT application performance. The above mentioned methodology can be either oriented towards more practical/system-related concepts. On the other hand, the methodology can also take more theoretical aspects/approaches into account, like for instance Age-of-Information analysis/optimization of edge systems. Depending on the previous knowledge of the applicant, either the one or the other direction in the project will be undertaken.

Visual Computing and Communication (Reg. No. 2036)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Markus Flierl
KTH School EECS		**Co-supervisor(s)**
KTH Department Intelligent Systems		**Main email contact** mflierl@kth.se

Specific subject area(s)
Signal representation, coding, and deep learning

Title of project
Deep Learning for Efficient Video Coding

Number of available positions
1

Earliest start date
1 August 2020

Exact duration of the position
min. 6 month, preferred 12 months, final duration upon agreement

Project website
https://people.kth.se/~mflierl/

Short description of the project
In this project, deep neural networks will be designed to improve the compression of video data.

Electrical and Computer Engineering (Reg. No. 2037)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Zhonghai Lu
KTH School EECS		**Co-supervisor(s)**
KTH Department Electronics and Embedded Systems		**Main email contact** zhonghai@kth.se

Specific subject area(s)
Hardware-Software Co-design, Computer Architecture, Embedded Systems

Title of project
Hardware Acceleration for Deep Learning

Number of available positions
1

Earliest start date
September 2020

Exact duration of the position
12 months

Short description of the project
The project investigates efficient reconfigurable hardware architectures and effective algorithm-architecture co-design methods to accelerate deep learning algorithms, which are now a critical component of computing and applied in more and more application domains. In particular, the project aims to provide efficient solutions for resource-constrained embedded systems.

Electrical Engineering, Asset Management (Reg. No. 2038)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Patrik Hilber
KTH School EECS		**Co-supervisor(s)** Ebrahim Shayesteh (Vattenfall)
KTH Department Electromagnetic Engineering		**Main email contact** hilber@kth.se

Specific subject area(s)
There are two main areas which need to be studied in this project: the first one is asset management and the second one is machine learning techniques.

Title of project
Improved power system asset management implementation using machine learning techniques

Number of available positions
1

Earliest start date
1 January 2020
Exact duration of the position
12 months

Project website
https://www.kth.se/eme/research/topics/rcam/qed-asset-management-group-former-rcam-group-1.39152

Short description of the project
Asset management has always been an important issue in maintaining and improving the performance of power systems. Moving toward more sustainable and smarter systems has increased the need for performing an optimal asset management even more. That is, through the advanced equipment used in smart power system, monitoring and control of the system is more achievable. However, dealing with a huge amount of data and implementing an optimal asset management plan are two significant challenges for these systems. In particular, the asset management problem in its complete form is a nonlinear problem. In our research group, some mathematical linearization techniques are used to replace the original asset management problem with a linear problem. This problem is then solved through linear optimization. Nevertheless, it is very difficult to solve the nonlinear optimization with too many input data.
It is proposed in this project to utilize the machine learning techniques to overcome such challenges. Using machine learning techniques to solve the asset management in a general way, for both linear and non-linear, is of high interest and importance to further improve the analysis.

The project will be run ion close collaboration with industry (Vattenfall).

Recommended background (at least one):
-Machine learning or optimization
-Power systems

Electrical Engineering (Reg. No. 2039)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Patrik Hilber
KTH School EECS		**Co-supervisor(s)** Ebrahim Shayesteh (Vattenfall)
KTH Department Electromagnetic Engineering		**Main email contact** hilber@kth.se

Specific subject area(s)
Preventive maintenance, condition monitoring, machine learning techniques, and asset management, applied statistics.

Title of project
Machine learning for improved condition assessment in power systems

Number of available positions
1

Earliest start date
1 January 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/eme/research/topics/rcam/qed-asset-management-group-former-rcam-group-1.39152

Short description of the project
The reliability of electric power system is becoming more and more important nowadays. This system reliability is directly affected by the reliability of different components in power system. To evaluate the component reliability, it is necessary to have a good assessment of the component conditions. These conditions mainly refer to the electrical status of the component, e.g., loading, maintenance, number of operations (for switches), and …. However, there are other conditions, e.g., weather conditions which can affect the reliability of electric power components. Through implementing more digitalized and controllable components in the system, there is better possibilities to evaluate component condition. Nevertheless, collecting accurate data and removing faulty data are important challenges that are necessary for correct condition assessment.
The main goal of this project is to implement machine learning techniques for appropriate condition assessment. To achieve this goal, different machine learning approaches are studied and applied to the condition assessment problem and a structured approach will be developed and presented. Further evaluation of the proposed approach will be done through collaboration with industry.

Recommended background (at least one):
-Machine learning or applied mathematics
-Electric power

Machine Learning, Computer Science (Reg. No. 2040)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** György Dán
KTH School EECS		**Co-supervisor(s)**
KTH Department Computer Science		**Main email contact** gyuri@kth.se

Specific subject area(s)
Security risk management for adversarial machine learning

Title of project
Machine learning in adversarial environments

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
Machine learning is finding use in a variety of industrial and societal applications, and shows a great promise in improving efficiency and manageability. Recent works show, however, that machine learning algorithms, especially those based on deep learning are susceptible to adversarial attacks, with severe and unpredictable impact on performance.

This project aims at developing algorithms for security risk management for mitigating adversarial attacks on machine learning. It will do so by developing a game theoretical model of adversarial attacks in the context of cyber-physical systems, and by analyzing the solution structure. It will furthermore develop solutions for improving the robustness of machine learning algorithms to adversarial input and for mitigating the impact of adversarial attacks on cyber-physical systems.

Electrical Engineering, Energy Storage Systems (Reg. No. 2041)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Daniel Månsson
KTH School EECS		**Co-supervisor(s)**
KTH Department Dep. of Electrical Engineering, Div. of Electromagnetic Engineering		**Main email contact** manssond@kth.se

Specific subject area(s)
Batteries, Lead-acid batteries

Title of project
Restoration of aged lead-acid batteries aided by electrically fast transients

Number of available positions
1

Earliest start date
2 March 2020

Exact duration of the position
12 months

Short description of the project
Background - need for energy storage:
Many places around the globe are very suitable for production of renewable energy using wind- and/or solar power. However, renewable energy is intermittent, not only from expected seasonal and daily variations but also due to more stochastic variations, e.g., from varying cloud coverage and gusts of wind. Therefore, such renewable sources requires some type of energy storage system (ESS) to store surplus power for later times of peak usage.

Energy storage systems - batteries:
Lead-acid batteries is the oldest technology (1859, Gaston Planté) for rechargeable batteries (i.e., secondary batteries) but is today often only associated with vehicles and SLI ("starting, lighting, ignition). However, lead-acid batteries have many favorable qualities (e.g., large power-weight ratio, low production cost, a large recyclability of ~98 %) that makes them (still) relatively competitive compared to more modern technologies. This especially in situations where the weight (i.e., energy density) is not a critical factor such as in a large stationary storage for, e.g., renewable energy. The downside of lead-acid batteries, compared to, e.g., Li-ion technology, is the shorter life cycle, the lower energy density and sensitivity to regular deep discharges.

When lead-acid batteries discharge amorphous lead sulfate is created (from the lead, lead dioxide and sulfuric acid) and it covers the electrodes. The process is then reversed when the battery is charged again. When the battery goes through many cycles some of the amorphous lead sulfate doesn't recombine back to the initial components but instead starts to crystallize. The same thing happens when the batteries are stored in a low charge (large DoD) state. The crystalline lead sulfate will build up over time and start to severely affect the capacity and power rating of the battery. This is one large reason for their disadvantage.

On the market there exist products today that claim to be able to "desulfate" even severely affected batteries, through various charging methods and schemes. However, in the scientific literature the publication material on this is very limited, even though the market possibilities of successful restoration of aged lead-acid batteries could be a huge step towards prolonging their life span and, thus, increase their competitiveness.

Project description:
The purpose of the work proposed here is to investigate the ability to restore (i.e., "desulfate") lead-acid batteries (with crystalline lead sulfate covering the electrodes) using different electrically fast transients (EFT) in combination with different charging methods. This is done via quantitative experiments on both single lead-acid cells and complete batteries to determine the state of the object as well as using numerical simulations tools such as COMSOL.

The student appropriate for this work presumably has, or wants to develop, a deep knowledge in energy storage systems and battery technology (electrochemical storage types). Also the student has an interest to plan, carry out and analyze results of experiments, analytical calculations and numerical simulations.

The project is done at the division of Electromagnetic Engineering at KTH and is in the form of a two year guest doctoral study suitable to combine with ongoing or future doctoral studies at the home university.

Space Plasma (Reg. No. 2042)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Andris Vaivads
KTH School EECS		**Co-supervisor(s)**
KTH Department Space and Plasma Physics		**Main email contact** vaivads@kth.se

Specific subject area(s)
magnetic reconnection, turbulence, energy conversion

Title of project
Turbulence in magnetic reconnection diffusion region measured in space plasmas

Number of available positions
1

Earliest start date
1 February 2020

Exact duration of the position
12 months

Short description of the project
Proposal deals with analysis of turbulence in magnetic reconnection using current spacecraft data, NASA/MMS and ESA/Cluster.

The guest PhD student would address the topic of understanding the turbulent properties of the magnetic reconnection diffusion region. Magnetic reconnection is one of the major energy conversion processes in space, e.g. leading to space plasma heating to hundreds millions of degrees. While simplified models of magnetic reconnection exist, satellite observations show the high complexity of the process where turbulence plays an important role in the plasma dynamics. Only in the last years, with availability of new spacecraft data, it has been possible to experimentally address the different important questions related to the turbulence in magnetic reconnection. The guest PhD student would study in detail diffusion regions of magnetic reconnection, regions where reconnection is initiated, and particularly study the generation of kinetic Alfvén waves that are thought to be one possible source of northern lights.

Production Engineering (Reg. No. 2043)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Lihui Wang
KTH School ITM		**Co-supervisor(s)**
KTH Department Department of Production Engineering		**Main email contact** lihuiw@kth.se

Specific subject area(s)
Scheduling and optimisation

Title of project
Multi-agent based job-shop scheduling and optimisation

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
24 months

Short description of the project
This project will focus on multi-agent based job-shop scheduling and related optimisation methods with incomplete information on manufacturing shop floors, aiming to developing evolutionary algorithms and designing decentralised auto-scheduling mechanisms in dynamic environments.

Mathematics (Reg. No. 2044)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Patrick Henning
KTH School SCI		**Co-supervisor(s)**
KTH Department Department of Mathematics		**Main email contact** pathe@kth.se

Specific subject area(s)
Numerical analysis

Title of project
Adaptivity and error estimation for nonlinear Schrödinger equations

Number of available positions
1

Earliest start date
1 June 2020
Exact duration of the position
12 months

Short description of the project
This project considers nonlinear Schrödinger equations with angular momentum rotation as they are commonly used to model the behavior of rotating superfluids. This includes both nonlinear Schrödinger eigenvalue problems as well as time-dependent Schrödinger equations. Considering corresponding finite element-based discretizations of the problems, the goal of the project is the derivation of computable and reliable error estimators that 1. allow to judge the quality of numerical solutions, 2. that can be used to predict the occurrence of vortex pattern (density singularities) in the superfluid and 3. that allow to refine the computational mesh adaptively so that the numerical solving becomes as efficient as possible. This project involves theoretical components in form of a posteriori error estimation for finite elements and it involves practical components in form of implementation and simulation tasks.

Nanotechnology (Reg. No. 2045)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Ilya Sychugov
KTH School SCI		**Co-supervisor(s)** Jan Linnros
KTH Department Department of Applied Physics		**Main email contact** ilyas@kth.se

Specific subject area(s)
Nanophotonics

Title of project
Highly Efficient Quantum Dots

Number of available positions
1

Earliest start date
1 June 2020

Exact duration of the position
12 months

Project website
https://www.aphys.kth.se/se/groups/photonics/research-groups/nano-silicon/nano-silicon-group

Short description of the project
The purpose of the project is a development of efficient semiconductor nanocrystal quantum dots for light conversion applications. Chemical synthesis methods and physical characterization techniques will be employed to achieve a large quantities of quantum dots exhibiting a high luminescence quantum yield.

Photonics (Reg. No. 2046)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Max Yan
KTH School SCI		**Co-supervisor(s)** Kristinn Gylfason
KTH Department Department of Applied Physics		**Main email contact** maxyan@kth.se

Specific subject area(s)
Mid-infrared, silicon photonics, thermal emission, metamaterial, gas sensor

Title of project
Integrated MIR Photonics

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/profile/miya

Short description of the project
Controlling infrared (IR) light has critical importance not only that IR radiation fundamentally regulates thermal energy flow in our environment but also that IR radiation enables augmented technologies in security monitoring, gas sensing, and life science. In this project we investigate critical integration techniques for mid-infrared (MIR, 3-8 μm) radiation on silicon platform towards mainly gas sensing application. Key components include thermal-emission based MIR sources, low-loss MIR waveguides, and even on-chip IR detection techniques. Knowledge to be developed/used: electromagnetic simulation, spectrally selective thermal emitter design, nanofabrication, infrared thermography, FTIR spectroscopy, system integration for gas sensing, etc. This is a collaboration project between Photonics unit (School of Engineering Sciences) and Micro and Nanosystems (School of Electrical Engineering and Computer Science), both at KTH.

Photonics (Reg. No. 2047)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Max Yan
KTH School SCI		**Co-supervisor(s)** Valdas Pasiskevicius
KTH Department Department of Applied Physics		**Main email contact** maxyan@kth.se

Specific subject area(s)
Electromagnetic waveguide, metamaterial, terahertz technology

Title of project
Microstructured Terahertz Fiber
Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/profile/miya

Short description of the project
Terahertz radiation (0.1-1 mm in wavelength) can penetrate common materials including skin, clothing, cardboard, plastic, etc. Therefore, besides high-speed free-space optical communication, terahertz waves are extremely attractive for medical imaging, material characterization, and security monitoring etc. Recently, much has happened on development of new terahertz sources. One of the leading groups is Laser Physics in KTH. However, guiding terahertz waves in a flexible way like what we do for traditional telecom light (1.5 um) is still a challenge, mainly because of relatively strong material absorption. Hollow-core terahertz fiber has been created with thin metal coating on its inner surface, but such a fiber is not flexible. The purpose of this project is to develop metamaterial-based terahertz fiber with potentially a propagation loss below 1 dB/m. The candidate is expected to take up challenges in electromagnetic simulation, micro-fabrication, and propagation-loss characterization of fabricated fibers.

Biophysics (Reg. No. 2048)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Lucie Delemotte
KTH School SCI		**Co-supervisor(s)**
KTH Department Department of Applied Physics		**Main email contact** lucie.delemotte@scilifelab.se

Specific subject area(s)
Computational membrane biophysics

Title of project
Molecular determinants of GPCR biased signaling using computational methods

Number of available positions
1

Earliest start date
As soon as possible

Exact duration of the position
12 months

Project website
https://www.biophysics.se/index.php/projects/delemottelab/tools/

Short description of the project
G-protein coupled receptors are capable of biased signaling, in which specific ligands activate signal transduction pathways that differ from the reference agonist. The molecular basis for this activity is not well understood. In this project we will use enhanced sampling molecular dynamics simulations to monitor the response of GPCRs to select ligands and will extract the features responsible for biased signaling using machine learning.

Photonics (Reg. No. 2049)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Max Yan
KTH School SCI		**Co-supervisor(s)**
KTH Department Department of Applied Physics		**Main email contact** maxyan@kth.se

Specific subject area(s)
Si photonics, electromagnetics, nanofabrication, optical characterization

Title of project
Si Photonics

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/profile/miya

Short description of the project
Silicon is the preferred material platform for integrated photonics and even future optoelectronic co-packaged systems. This project looks into emerging areas in Si photonics from both theoretical and experimental perspectives. Among others, we are interested in silicon-based subwavelength structure for controlling dispersion, phase, temporal delay, polarization, modal profile etc., as well as integration of nonlinear materials on silicon for frequency conversion. Solid theoretical background is required. He or she can also be involved partly in nanofabrication and optical characterization.

Large Eddy Simulation of Turbulent Combustion with Detailed Chemistry (Reg. No. 2050)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Christophe Duwig
KTH School SCI		**Co-supervisor(s)**
KTH Department Department of Mechanics		**Main email contact** duwig@kth.se

Specific subject area(s)
Simulation of swirl combustor, simulation of turbulent combustion in the distributed flame regime, comsbution data analysis

Title of project
Simulation of Wet Combustion for future gas turbines
Number of available positions
1

Exact duration of the position
12 months

Earliest start date
Spring 2020

Short description of the project
This project deals with simulations of turbulent combustion in the so-called wet combustion regime. We consider flames in swirling combustors and study numerically the influence of steam addition. With high dilution levels, the flame enters the so-called distributed flame regime, where the reaction zone transitions form a thin sheet (so-called flamelet) to a thick band (distributed flame).
The objective is to understand this combustion regime. To that end we will perform large eddy simulation with detailed chemistry and use the high-fidelity simulations to understand the mechanisms at play for flame stabilisation.

Engineering Mechanics (Reg. No. 2051)

Type of position Guest doctoral study: 6-24 months (no degree awarded)		**Main supervisor** Sebastian Stichel
KTH School SCI		**Co-supervisor(s)** Carlos Casanueva
KTH Department Farkost och Flyg		**Main email contact** stichel@kth.se

Specific subject area(s)
Rail Vehicle Dynamics

Title of project
Understanding railway-wheel polygonization with help of simulation

Number of available positions
1

Earliest start date
1 November 2020

Exact duration of the position
24 months

Short description of the project
Both high-speed and metro vehicles in China suffer from wheel polygonization. In recent years several researchers have been working on finding the root causes of the phenomenon, often with help of simulation models. These simulation models include time domain simulations, contact modelling and wear calculation.

The time domain simulations include both rigid and flexible bodies. Up to now the only flexible body that has been considered in most of the studies is the wheelset flexibility. Measurements and field studies, however, suggest that the bogie flexibility should be taken into account as well.

Almost all researchers have used Hertz and Fastsim to solve the contact problem. However, recent studies show that this combination has considerable shortcomings and should be replaced by more correct methodologies such as ANALYN and FASTRIP which recently have been developed at KTH.

The idea for the project is to modify an MBS software to be able to use the recently developed contact models to calculate wear online while the simulations are running. Only then one can consider the effects of polygonization on the dynamic behaviour including the excitation of the modes of vehicle components. The excitation of certain mode shapes will create and accelerate the polygonization.

Visiting Scholar: 3-12 months

Evolutionary Genetics and Genomics (Reg. No. 2052)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Peter Savolainen
KTH School CBH		**Co-supervisor(s)** Pelin Sahlen
KTH Department Department of Gene Technology		**Main email contact** savo@kth.se

Specific subject area(s)
Identification of regulatory sequences and genes under selection in the domestication, by mapping of promoters and enhancers, and genome sequencing. Phylogeographic analyses

Title of project
Evolution of the dog: identification of genes selected at the domestication and the geographic origin

Number of available positions
2

Earliest start date
1 June 2020

Exact duration of the position
12 months

Project website
https://www.kth.se/gte/evolutionary-biology-and-forensics-1.783359

Short description of the project
This project is based on a long-established collaboration between Sweden and China, with the research group of Professor Ya-ping Zhang at Kunming Institute of Zoology, Chinese Academy of Sciences. In a number of prominent papers we have previously, based on large-scale genetics and genomics, indicated South China as the probable region of dog origins, and identified genes under selection in the first phase of dog evolution, affecting e.g. digestion and behaviour.

Previous studies were based on genome sequencing, which can identify only roughly 50% of the affected genes, since most mutations are situated in regulating regions far from the affected genes. We will now perform more precise studies to identify regulatory sequences and genes under selection in the domestication, by mapping of promoters and enhancers and their interactions, and genome sequencing.

We will also analyse all types of genetic markers: nuclear genomes as well as mitochondrial, Y-chromosomal and X-chromosomal DNA, for refined phylogeographic analyses.

Because of the broad aims of this study, students with different backgrounds are welcome to apply; molecular biology, bioinformatics or phylogeographic analysis.

Biology (Reg. No. 2053)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Adil Mardinolgu
KTH School CBH		**Co-supervisor(s)**
KTH Department Protein Science		**Main email contact** adilm@kth.se

Specific subject area(s)
Systems biology; Pharmacology; Cancer

Title of project
Investigating the anti-gastric cancer mechanism of 50 kinds of crude drug Standard extract based on systems biology

Number of available positions
1

Earliest start date
1 April 2020

Exact duration of the position
12 months

Short description of the project
Traditional medicine is the cultural and historical heritage of China, and there are around 5000 known formulation in traditional Chinese medicine. Most of the formulations of Chinese medicine are based on different herbs, and provide a huge biobank of plants which could be potentially used in clinic. However, very few study investigated their effects on cells at systems level. In this project, we aimed at investigating the transcriptomic changes of human cancer cell lines before and after the treatment of 50 selected herbs from Chinese medicine using systems biology tools, respectively. In addition, we would also develop a metabolomics-based molecular signature for quality control of the herb extracts. Moreover, we would identify the effective small molecules that could potential be used for cancer treatment.

Theoretical Chemistry and Physics (Reg. No. 2054)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Victor Kimberg
KTH School CBH		**Co-supervisor(s)**
KTH Department Theoretical Chemistry and Biology		**Main email contact** kimberg@kth.se

Specific subject area(s)
Strong field X-ray science

Title of project
Non-linear X-ray spectroscopy of structure and dynamics in liquids

Number of available positions
1

Earliest start date
1 April 2020

Exact duration of the position
12 months

Short description of the project
The invention of X-ray free-electron laser (XFEL) with ultra-short pulses of high intensity has opened the way to transfer nonlinear spectroscopy from the optical to the X-ray regime, allowing to explore rich new physical processes and applications. The present project aims to meet the exciting opportunities and challenges through the development of new models and theory of disordered systems, like liquids, to predict and understand the deep new phenomena which will be unraveled by coming nonlinear spectroscopy based on XFELs. Understanding and modeling quantum nuclear effects in liquids is one of the major challenges of modern condensed matter physics. The present project is aimed to perform quantum-classical simulations for description the nuclear dynamics in the liquids under strong XFEL pulse excitation. X-ray absorption spectroscopy (XAS) [1] and Resonant Inelastic X-ray Scattering (RIXS) [2] techniques were recently successfully applied by our theoretical group and our experimental collaborators for the study of structure and dynamics in liquid water. In the present project, the stimulated X-ray emission and stimulated resonant inelastic X-ray scattering in liquids and solutions will be explored theoretically and proposed for experimental verification, based on our previous development [3-4]. The project is motivated by that the full potential of XFELs for the new applications for study of disordered systems is yet to be discovered. There is a strong request for realistic numerical modeling and method development from the whole community of strong field X-ray physics. The applicant will join a team which includes researchers with strong expertise in different theoretical approaches required for studying X-ray nonlinearity. Our group also have long term collaboration with the experimental groups working at modern XFEL facilities (MAX IV, European XFEL, etc), where our theoretical findings can be confirmed and push forward new developments in the field of linear and nonlinear X-ray science.
[1] J. Niskanen, et al., Proc Natl Acad Sci USA 116, 4058-4063 (2019).
[2] V. Vaz da Cruz, et al., Nature Communication 10, 1013 (2019).
[3] V. Kimberg, et al., Faraday Discuss. 194, 305–324 (2016).
[4] V. Kimberg and N. Rohringer, Struct. Dyn. 3, 034101 (2016).

Visual Computing and Communication (Reg. No. 2055)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Markus Flierl
KTH School EECS		**Co-supervisor(s)**
KTH Department Intelligent Systems		**Main email contact** mflierl@kth.se

Specific subject area(s)
Deep learning and optimal information retrieval

Title of project
Deep learning, compression, and optimal information retrieval

Number of available positions
1

Earliest start date
1 August 2020

Exact duration of the position
min. 3 month, preferred 12 months, final duration upon agreement

Project website
https://people.kth.se/~mflierl/

Short description of the project
In the future, the amount of information stored in databases will increase significantly. This project will consider deep neural networks to approach the problem of optimal information retrieval for large databases.

Machine Learning, Computer Science (Reg. No. 2056)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** György Dán
KTH School EECS		**Co-supervisor(s)**
KTH Department Computer Science		**Main email contact** gyuri@kth.se

Specific subject area(s)
Security risk management for adversarial machine learning

Title of project
Machine learning in adversarial environments

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
Machine learning is finding use in a variety of industrial and societal applications, and shows a great promise in improving efficiency and manageability. Recent works show, however, that machine learning algorithms, especially those based on deep learning are susceptible to adversarial attacks, with severe and unpredictable impact on performance.

This project aims at developing algorithms for security risk management for mitigating adversarial attacks on machine learning. It will do so by developing a game theoretical model of adversarial attacks in the context of cyber-physical systems, and by analyzing the solution structure. It will furthermore develop solutions for improving the robustness of machine learning algorithms to adversarial input and for mitigating the impact of adversarial attacks on cyber-physical systems.

Electrical and Computer Engineering (Reg. No. 2057)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Zhonghai Lu
KTH School EECS		**Co-supervisor(s)**
KTH Department Electronics and Embedded Systems		**Main email contact** zhonghai@kth.se

Specific subject area(s)
Computer Engineering, Embedded Systems

Title of project
Memory System in Many-Core Computers

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
The project investigates effective methods to extend the lifetime, power efficiency and access performance of flash memory in the memory hierarchy of computer systems.

Optimization and Machine Learning (Reg. No. 2058)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** György Dán
KTH School EECS		**Co-supervisor(s)** James Gross
KTH Department Computer Science		**Main email contact** gyuri@kth.se

Specific subject area(s)
Distributed systems, resource management

Title of project
Trustworthy resource management for edge computing

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
Edge computing is emerging as a computing paradigm that will enable a variety of cyber physical system (CPS) applications in future mobile networks, through low latency access to distributed computing resources. Combined with adaptive resource management based on principles inspired by recent advances in machine learning, edge computing could be also a cost efficient approach for relieving networks from significant IoT traffic. Nonetheless, in order for CPS and IoT applications to be able to rely on edge computing, edge computing has to provide predictable performance despite the openness of edge computing systems, the usage of off-the-shelf components as well as the shared nature of the edge infrastructure.

The objective of this project is to develop algorithms and fundamental engineering principles for making resource management in edge computing system predictable. Starting from a stochastic characterization of wireless technologies and computing platforms, we will develop a methodology for providing predictions of end-to-end latency based on principles of hierarchical machine learning models. Results obtained for single edge deployments will then be generalized to capture the interaction between edge computing systems and centralized clouds, focusing on resource allocation and placement. Finally, the predictability of the communication and computing infrastructure will be jointly optimized with application capabilities, so as to ensure predictable CPS and IoT application performance. The above mentioned methodology can be either oriented towards more practical/system-related concepts. On the other hand, the methodology can also take more theoretical aspects/approaches into account, like for instance Age-of-Information analysis/optimization of edge systems. Depending on the previous knowledge of the applicant, either the one or the other direction in the project will be undertaken.

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Space Plasma (Reg. No. 2059)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Andris Vaivads
KTH School EECS		**Co-supervisor(s)**
KTH Department Space and Plasma Physics		**Main email contact** vaivads@kth.se

Specific subject area(s)
magnetic reconnection, turbulence, energy conversion

Title of project
Turbulence in magnetic reconnection diffusion region measured in space plasmas

Number of available positions
1

Earliest start date
1 February 2020

Exact duration of the position
3 months

Short description of the project
Proposal deals with analysis of turbulence in magnetic reconnection using current spacecraft data, NASA/MMS and ESA/Cluster, and preparatory work for the future space missions involving close collaboration between KTH and China.
The guest professor Fu scientifically would address the turbulence in magnetic reconnection related to the topological structure of turbulence environment. The work is based on earlier collaborative studies with professor Fu. In addition, an important part of the visit would be preparatory work for the future multi-spacecraft missions addressing cross-scale coupling in space plasma which involves close collaboration between KTH and China. For example, one concept of such mission (Self-Adapative Magnetic reconnection Explorer) is currently under preparation within the Strategic Priority Research Program on Space Science II of Chinese Academy of Sciences.

Production Engineering (Reg. No. 2060)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Lihui Wang
KTH School ITM		**Co-supervisor(s)**
KTH Department Department of Production Engineering		**Main email contact** lihuiw@kth.se

Specific subject area(s)
Robotic machining

Title of project
Research on robotic machining and feasibility investigation

Number of available positions
1

Earliest start date
1 September 2020

Exact duration of the position
12 months

Short description of the project
This research will focus on the feasibility of using industrial robots in precision machining. Successful candidate will work on robotic dynamics and control to properly compensate errors and generate runtime trajectory adaptive to the real situation of robot-cutter-workpiece engagement. The candidate is expected to publish two scientific papers during the study visit at KTH.

Nuclear Engineering (Reg. No. 2061)

Type of position Visiting scholar: 3 - 12 months		**Main supervisor** Janne Wallenius
KTH School SCI		**Co-supervisor(s)** Sara Bortot
KTH Department Physics		**Main email contact** janwal@kth.se

Specific subject area(s)
Reactor Physics

Title of project
Development of control system for a small lead-cooled reactor
Number of available positions
1

Project website
https://www.physics.kth.se/ne/lcr

Earliest start date
1 September 2020

Exact duration of the position
9 months

Project website
https://www.physics.kth.se/ne/lcr

Short description of the project
In this project the development of a control system for a small lead-cooled reactors capable to respond to perturbations without deviating from prescribed operational regime will be developed and simulated using SIMULINK/MATLAB. The project will be carried out in close collaboration with a researcher (Sara Bortot) and a PhD student funded by a VR-grant (to be employed).