

Research Exchange at Beihang University

Academic Year 2017-2018



International Division
Beihang University

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Notes: These projects are all in English and based at six schools.

- 17F01-03: School of Materials Science and Engineering
- 17F04: School of Automation Science and Electrical Engineering
- 17F05-13: School of Mechanical Engineering and Automation
- 17F14-19: School of Economics and Management
- 17F20: School of Computer Science and Engineering
- 17F21: School of Space and Environment

How to apply:

Applicants themselves should first contact prospective supervisors by sending a CV and a motivation letter. Please copy international@buaa.edu.cn when you contact a professor.

For detailed application procedures and assistance, please visit:
<http://global.buaa.edu.cn>

17F01 - Nanomaterials for infrared-shielding

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School

School of Materials Science
and Engineering

SPECIALIZATION

My research interests are mainly centered on three topics:

Photochemistry: Synthesis and characterization of photocatalytic and UV or infrared-shielding nanomaterials.

PROJECT DESCRIPTION

There has been great demand to control the Near-Infrared Radiation (NIR, wavelength of 780 to 2500 nm) (heat rays) by employing transparent coating on the windows of automobile and building. Such transparent coating with infrared filtering property will reduce energy consumption for the air conditioning and thereby decrease the emission of carbon dioxide from the housing and automobile. Consequently, a remarkable absorption of near infrared together with high visible light transmittance is required for solar control filter.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment, and will receive significant training on nanomaterials synthesis, characterization, and electrochemistry. Specifically, the candidate will learn how to use this green chemistry technology to synthesize various nanostructures and further to control their morphology and how to perform microscopic characterizations, including scanning electron (SEM), transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM) imaging, X-ray diffraction (XRD) analysis, etc.

REQUIRED SKILLS

Inorganic chemistry, and/or materials.

Students interested in this project should have a basic knowledge in chemistry, at least at the second year level (general chemistry, introductory thermodynamics and some laboratory work are

typical at this stage). Students in chemistry, physics, chemical engineering or materials science and engineering usually have the necessary background. The project requires a strong work ethic and interest in learning a range of instrumentation.

17F02 - Aniline oligomer derivatives with mechanochromic and aggregation-induced emission characteristics

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School

School of Materials
Science and Engineering

SPECIALIZATION

Functional materials, special adhesives and composite materials development

PROJECT DESCRIPTION

Organic light emitting materials have advantages of small power consumption, large viewing area, organic molecules, non-electromagnetic radiation, processing performance, good environmental resistance, etc. Meanwhile, the organic light-emitting materials with molecular structure determination, which are easy to synthesis, are more conducive to study the relationship between structure and properties of materials.

Aggregation-induced emission (AIE) phenomenon can be a good solution to solve the fluorescence quenching effect, at the intersection of optoelectronic devices, photo storage, logic gates, and others which have a wide range of potential applications.

Our research will design and synthesis a series of aniline oligomer derivatives with various enamine fragments by amine-aldehyde reaction. Based on these aniline oligomer derivatives with specific molecular weight, we will further investigate their AIE properties with the effects of chain length, content and sequence structure of enamine fragments and types of end group.

Thus, as the system of aniline oligomer derivative materials are built, AIE luminous mechanism will be widely developed.

STUDENT ROLES

The student will learn to experiment independently and use material testing instrumentations.

REQUIRED SKILLS

Organic synthesis, polymer and/or optical chemistry

Students interested in this project should have a basic knowledge in organic chemistry and a strong work ethic and interest in learning a range of instrumentations.

17F03 - High entropy alloy with high neutron irradiation resistance

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School

School of Materials
Science and Engineering

SPECIALIZATION

My research focuses on the investigation of titanium alloy, aluminium alloy, high temperature alloy, special steel, as well as high entropy alloys and biological composite for multiple applications. Specifically, our research interests are mainly centered on five topics:

- (1) Material strengthening mechanisms, structural integrity and safety assessment.
- (2) Structure damage tolerance, residual strength assessment and residual life prediction.
- (3) Fatigue fracture and wear properties;
- (4) Microstructure characterization and embrittlement analysis of the material in extreme environment
- (5) Design of multi-functional materials for nuclear applications, such as high entropy alloy.

PROJECT DESCRIPTION

High Entropy Alloys (HEAs) are composed of four or more metallic elements mixed in an equimolar or near equimolar ratio. The introduction of multicomponent high entropy alloys has changed the conventional alloy design process in which only one or two principal elements determine the material primary properties. As an increasing demand of advanced nuclear fission reactors and fusion facilities, the key requirements for the materials used in advanced nuclear systems should encompass superior high temperature property, good behavior in corrosive environment, and high irradiation resistance, etc.

Recently, it was found that some selected HEAs possess excellent mechanical properties at high temperature, high corrosion

resistance, and no grain coarsening and self-healing ability under irradiation, especially, the exceptional structural stability and lower irradiation-induced volume swelling, compared with other conventional materials. Thus, HEAs have been considered as the potential nuclear materials used for future fission or fusion reactors, which are designed to operate at higher temperatures and higher radiation doses.

The proposed research project is to design and fabricate new types of HEAs with excellent mechanical properties and irradiation resistance for nuclear applications. The research provides an insight into the irradiation behavior of HEAs, including fundamental researches to investigate the irradiation-induced phase structure change and volume swelling in HEAs.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment, and will receive significant training on material synthesis, characterization, and neutron irradiation. Specifically, the candidate will learn how to use powder metallurgy and electric arc melting technology to synthesize various high entropy alloys and how to perform microscopic characterizations, including scanning electron (SEM), transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM) imaging, X-ray diffraction (XRD) analysis, etc.

REQUIRED SKILLS

Material science, and/or material processing.

Students interested in this project should have a basic knowledge in material science, at least at the second year level. Students in material science or material processing usually have the necessary background. The project requires a strong work ethic and interest in learning a range of instrumentation.

17F04 - Robotics and actuation technology

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School

School of Automation
Science and Electrical
Engineering

SPECIALIZATION

My research focuses on robotics and high performance actuation technology. Specifically, our research interests are mainly centered on following topics:

- (1) Robotics: Industrial robots, Parallel and serial robots, Capsule robots, Entertainment robots, Modular robots.
- (2) Unmanned aerial vehicle (UAV): Ornithopter with different sizes.
- (3) Actuation technology: Multi-DOF spherical actuators, Permanent magnet linear machines, Reluctance-switching linear machines, Rotary machines, Micro-actuators, Piezoelectric actuators.

PROJECT DESCRIPTION

The students can join two types of research projects:

(We may accept two candidates if they are qualified.)

1. Development of hybrid robotic system: Parallel or serial robots are widely used in industries. Generally, parallel robot can achieve high-stiffness and high-precision motions. However, its workspace is relatively small. To solve this problem, we proposed one hybrid robot, i.e., combining both serial and parallel mechanisms. Coarse-fine manipulation technology will be employed for the control purpose.
2. Development of high-performance electromagnetic actuators: The output performance of electromagnetic machines is mainly determined by the magnetic flux density and current input in the system. The maximum current input is generally constrained by the thermal effect. Therefore, increasing flux density is one good option to achieve high force or torque output of electromagnetic devices. Our target is to increase the system power density, i.e., we

try to reorganize the magnet arrays in the machine so that the flux density can be increased in the same volume.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment, and will receive significant training on robotics, electromagnetic, and electric machines. Specifically, the candidate will learn how to use mechanical software to design robotic systems and analyze their motions in three-dimensional space (for projects on robot design), or finite element software to analyze magnetic field distribution and force torque output of electromagnetic machines (for projects on actuation design). Control algorithm could be considered to complete various tasks of the robotic systems, or improve the output performance of electric machines.

REQUIRED SKILLS

Fundamentals of mechanical design

Students interested in this project should have a basic knowledge in mechanical design, at least at the second year level (general mechanical design knowledge, introductory mechanical components and some laboratory work are typical at this stage). Students in mechanical, electrical or automation engineering usually have the necessary background. The project requires a strong work ethic and interest in learning a range of instrumentation.

17F05 - Wire + arc additive manufacturing (WAAM) for large scale aluminum alloy components

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School of Mechanical
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SPECIALIZATION

Our research focus on high frequency pulsed welding of aluminum alloys, titanium alloys and stainless steels using gas tungsten/metal arc welding (GTAW/GMAW); welding metallurgy of aluminum alloys, titanium alloys and stainless steels; weld formation and solidification behavior. Currently we have a large research activity on additive manufacture (AM) using weld build up for aerospace applications.

This activity is led by Dr. CONG and we have three Ph.D. and several master students as well. The research is also partly carried out in collaboration with Prof. Stewart Williams in Cranfield University, UK. The focus for this work has so far mainly been high strength aluminum alloy but we are also moving on to titanium parts. The objective would be to contribute to the research effort with a view to pushing the technology.

PROJECT DESCRIPTION

Aluminum alloys have been widely applied in aeronautic and aerospace industry due to their excellent strength, fracture properties and good corrosion resistance. The conventional method of manufacturing aluminium alloy components is using subtractive processes which machine the component out of a solid alloy block. The massive amount of waste cannot satisfy the continuously increasing requirements of sustainable, clean and resource-efficient. Wire + arc additive manufacturing (WAAM) is becoming more popular due to its high deposition rate, low production cost and the capability for fabricating large-scale components, compared with other additive manufacturing (AM) processes. Nowadays, there is a requirement from aerospace industry to apply WAAM technology for manufacturing aluminum alloy structures.

The proposed research project is to apply WAAM technology to manufacture large scale aluminum alloy components. Different arc modes, such as VP-GTAW, HPVP-GTAW, CMT, pulsed CMT and pulse advanced CMT, and different filling wires, such as ER2319, ER5087, ER5356, ER6061 and some special materials, will be employed for building components. The characteristics, such as formation, microstructure, porosity and mechanical properties, of fabricated components will be investigated in detail. All these studies will contribute to the application of WAAM aluminum alloy in aerospace industry.

(1) Single-wire WAAM aluminum alloy with gas tungsten arc welding (GTAW) process: commercial and special materials;

(2) Double-wire WAAM aluminum alloy with GTAW process: Al-Cu + Al-Mg; Al-Mg + Al-Si, et al;

(3) WAAM aluminum alloy with hybrid pulse variable polarity gas tungsten arc welding (HPVP-GTAW) process, which was developed by our team;

(4) WAAM aluminum alloy with gas metal arc welding (GMAW) process, specially with different cold metal transfer (CMT) variants.

STUDENT ROLES

The student will be actively engaged in working on WAAM topics, and will receive significant training on aluminum alloy WAAM process and theoretical analysis of fabricated structure characteristics. Specifically, the candidate will learn how to build components using WAAM process, how to perform microscopic characterizations, including optical microscope (OM), scanning electron (SEM), electron backscatter diffraction (EBSD), X-ray diffraction (XRD) analysis, etc., and how to perform mechanical properties, including micro-hardness and tensile strength, etc.

REQUIRED SKILLS

Metal material science, and/or welding.

Students interested in this project should have a basic knowledge in metal material science or welding, at least at the second year

level (metal material welding and some laboratory work are typical at this stage). Students in materials processing engineering or metal materials science and engineering usually have the necessary background. The project requires a strong work ethic and interest in learning a range of instrumentation.

17F06 - Laser processing for novel micro-/nano-structures

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School

School of Mechanical
Engineering and
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SPECIALIZATION

Prof. GUAN' s current research interest focuses on laser material processing, laser-based additive manufacturing and hybrid laser fabrication for surface functionalization.

PROJECT DESCRIPTION

Laser surface processing has been considered as an advanced alternative over conventional counterparts to improve the surface properties of materials. Moreover, short processing time, flexibility in operation, economy in time/energy/material consumption, shallow heat affected zone, and precision are the important advantages of laser processing methods.

Our research will apply recent laser surface technologies to address main challenges including optical properties, corrosion protection, wear resistance, cell adhesion in both metallic materials and controlled features in nanomaterials. The proposed research project is to fabricate new types of surface and subsurface structure such as noble micro-/nano-structures (e.g. dots, groves, etc.) for both nanomaterials and Ti-based or Mg-based alloys. The successful candidate will develop two-dimensional (2D) and three-dimensional (3D) noble micro-/nano-structures for aerospace and biomedical applications.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment, and will receive significant training on material processing, characterization, and properties measurement. Specifically, the candidate will learn how to use short pulse laser technology to fabricate various noble micro-/nano-structures and further to control their

morphology and how to perform microscopic characterizations, including scanning electron (SEM), transmission electron microscopy (TEM), high resolution transmission electron microscopy (HRTEM) imaging, X-ray diffraction (XRD) analysis, thermal measurement, process simulation and optimization, etc.

REQUIRED SKILLS

Metallurgy, Biomaterials, Mechanical Engineering, Materials Science and Engineering

Students interested in this project should have a basic knowledge in physics or materials, at least at the second year level. Students in material science, physics or chemical engineering usually have the necessary background. The project requires a strong work ethic and interest in learning a range of instrumentation.

17F07 - Key technology of magnetic-grating-like hydraulic cylinder integrated displacement sensor

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School of Mechanical
Engineering & Automation

SPECIALIZATION

My research interests are mainly centered on the following topics:

(1) Hydraulic servo system and equipment.

(2) Aerospace electrically actuators (EHA, EMA).

(3) Industrial robots design and control

PROJECT DESCRIPTION

According to the fact that the existing displacement sensor could not effectively achieve the requirement of new type hydraulic actuators such as EHA and single rod symmetrical cylinder for high reliability, high security, high power-weight ratio and high accuracy. A high magnetic-grating-like hydraulic cylinder was proposed based on the unique detection and hydraulic cylinder.

Our research will apply electromagnetism and signal processing to address the above challenges. Initially, due to the difficulty of quantitative analysis, a mathematical model of magnetic-grating-like hydraulic cylinder should be established. Second, in order to improve the accuracy of the sensor, present an optimum structure solution theory of the magnetic-grating-like hydraulic cylinder piston rod and the permanent magnet object via the study of magnetic lines modulation. Third, analyze the influences on the magnetic-grating-like hydraulic cylinder displacement sensor accuracy of the different piston rod shapes and the relative position between the permanent magnet object and the sensitive element. Finally, through the established special harmonic signal subdivision accuracy evaluation function, acquire a design method of the hydraulic cylinder.

The successful candidate will develop a high precision Magnetic-grating-like hydraulic cylinder.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment, and will receive significant training on mechanical-electrical integration and hydraulic components. Specifically, the candidate will learn how to use some professional tools such as Ansoft Maxwell to analysis the Changing magnetic field. Besides, basic knowledge of mechanical design is required.

REQUIRED SKILLS

Electromagnetism and Signal Processing

Students interested in this project should have a basic knowledge in Electromagnetism and Signal Processing, Strong work ethic and interest are required in this project.

17F08 - Anti-crash aircraft design

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School

School of Mechanical
Engineering & Automation

SPECIALIZATION

One of my research directions is the anti-crash aircraft design, aiming to reduce the death rate in air-crash.

This research mainly consists of three aspects.

- (1) the design of anti- falling structure for aircraft
- (2) the selection of the material and the analysis of elasticity, plasticity and impact resistance
- (3) the feasibility analysis of anti-falling aircraft (economic cost, space volume, safety performance, etc.)

PROJECT DESCRIPTION

Although the safety of the aircraft is relative higher than many other vehicles, but in the event of an accident, the survival rate is very low concerning the current anti-crash technology.

In order to solve this problem, it is of practical significance to design the anti-crash aircraft.

STUDENT ROLES

Students should have a background in science and engineering (such as mechanical design, or equipment design, or materials science, or industrial design, etc.). They need to learn about aircraft structure and material properties for this project. Students will participate in the design of anti-crash aircraft to improve the safety of the aircraft by analyzing structure.

REQUIRED SKILLS

Students who are interested in this project should have a background in science and engineering, skills of 3D modeling, MATLAB and other software is in need. Students also need to have strong enthusiasm.

17F09 - Noise reduction design in aircraft cabin

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School

School of Mechanical
Engineering & Automation

SPECIALIZATION

One of my research directions is the design of methods aiming to reduce aircraft cabin noise in aircraft cabin.

This topic mainly analyzes the influence of engine noise and air conditioning noise on the cabin, consisting of three aspects.

(1) analysis of the effects of vibration performance of aircraft skin and rib plate on transmission performance

(2) the design of air conditioning pipe muffler

(3) analysis of the sound absorption performance of the interior trim panel and carpet

PROJECT DESCRIPTION

Aircraft engine noise affects the comfort and safety of passengers in the cabin, also having some influences on the aircraft equipment. This project studies the noise spectrum characteristics of aircraft engine, the influence of engine on the fuselage vibration, analysis of the vibration performance of the outer skin of the aircraft, the sound absorption and sound insulation between the outer skin and the interior trim, and the design of the substitute.

This project also involves analysis of the influence of air conditioning noise on the cabin, design of air conditioning pipe muffler, analysis of the sound absorption performance of the interior trim panel, carpet, etc.

STUDENT ROLES

Students need to learn to understand the structure of aircraft and aircraft material properties, through structural analysis, involved in the design of a better sound insulation properties of the structure or material, reduce cabin noise, improve the cabin comfort and security.

REQUIRED SKILLS

Students interested in this program should have a mechanical design, or physics or other aspects of knowledge background, and some basic knowledge of 3D modelling design, MATLAB or other software. Students also need to have a strong work ethic and work passion.

17F10 - The control of coastal desert

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School

School of Mechanical
Engineering & Automation

SPECIALIZATION

One of my research directions is the control of coastal desert, mainly for the coastal areas of the desert proposed governance programs, such as Saudi Arabia and Dubai desert.

Mainly consisting of four aspects:

(1) analysis of the natural condition in the desert coastal area, latitude and altitude, the main wind direction, ocean currents and temperature, humidity in the coastal area of mountain hills and plain geographical analysis, underground soil analysis, the local coastal microbial survival condition

(2) the design of desert water diversion

(3) protection of desert microorganisms

(4) desert soil and water conservation design

PROJECT DESCRIPTION

The desert is part of nature in some areas deserts have lost their ecological balance. How to control the process of desert and desertification is very important. In this project, the desert of the coastal areas as the object of governance, put forward feasible solutions, such as Saudi Arabia, Dubai desert control.

The first step to study the desert of the coastal areas natural conditions is analysis, such as longitude, altitude, direction, direction, main currents, temperature and humidity in the mountain hills of coaster area and geographical analysis, underground soil analysis, the local coastal microbial survival status; the second step is analysis of the survival conditions of the desert environment design for microorganisms, microbial growth, desert soil and water conservation design ; the third step is the desert water diversion design , putting forward the feasible scheme for desert greening.

STUDENT ROLES

Students who are interested in this project should have a background in science and engineering. Students need to learn the knowledge of geography, desert and ocean knowledge, and have the ability of analysis of the ecological environment and microbial growth conditions. In this project, students will participate method of desert control design, as focusing on microorganism, to propose a suitable auxiliary structure of microbial growth, to promote microbial breeding, promote the growth of plant, and to put forward a feasible design scheme for desert area green.

REQUIRED SKILLS

Students who are interested in this project should have the sense of environmental protection and strong working passion, good analytical skills and ability to communicate, and some skills of the 3D design software design and the ability to use MATLAB software. Students also need to have a strong work ethic.

17F11 - Island water development

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School of Mechanical
Engineering & Automation

SPECIALIZATION

One of my research directions is the design of island water, which is based on the problem of island water use. Mainly consisting of four aspects:

(1) analysis of island geographical position, the current trend, perennial wind etc.

(2) the rock and soil properties of the hills in the island (the present situation of the rock capillary, the angle of the rock surface slope, etc.)

(3) analysis of microorganisms and vegetation on islands

(4) the design of water diversion and storage

PROJECT DESCRIPTION

For islands that lack fresh water, how do we use seawater to obtain fresh water?

This project is to study the water permeability of the rock and soil and the natural condition of the capillary. Based on the principle of siphon and capillary, this project aims to design to provide water resources and water storage for the residents on the island. Design seepage line, the use of sea island mountain natural water absorption performance and the wave of waves to boost the role of the island to provide water resources and water storage, for the residents on the island.

In addition, this project will assess the feasibility and methods for searching for fresh water below the seabed by finding specific structure such as whirl and current under island, reef and the others.

STUDENT ROLES

Students need to have a background in science and engineering, and need to learn about the geography, ocean and other aspects of knowledge, to participate in the design.

REQUIRED SKILLS

Students who are interested in this project should have strong creative passion, and need to show your problem analysis and problem solving ability and team work spirit. It is also needed to have skills of 3D design software and MATLAB, etc.

(Best, you can swim.)

17F12 - Floating island design

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School of Mechanical
Engineering & Automation

SPECIALIZATION

One of my research is the design of the floating island, the redesign of the new home is mainly aimed at the island of the world is about to disappear or sink. Mainly consisting of four aspects:

- (1) the overall design of the floating island;
- (2) selection of floating island material;
- (3) analysis of the strength of the floating island;
- (4) the relationship between floating islands and marine ecology.

PROJECT DESCRIPTION

With the change of world ocean climate, sea level is gradually increasing. As a result some islands are about to disappear or sink. Islands such as Malta, for the survival of mankind, need to design a new home for the people of these islands - floating island.

The new concept of floating island can also be used as a tourist industry, or a support for marine aquaculture. Mainly consisting of four aspects:

- (1) The overall design of the floating island;
- (2) Feasibility analysis;
- (3) The selection and strength analysis of floating island material;
- (4) The analysis of the relationship between the floating island and marine ecology, and the life age of the floating island.

STUDENT ROLES

Students need to have a background in science and engineering, and need to learn about geography, marine, ship and other aspects of knowledge, to participate in the floating island design.

REQUIRED SKILLS

Students who are interested in this project should have strong creative passion to participate in design. You need to demonstrate your analytical and problem solving skills, team work spirit, some 3D design software skills and presentation skills, and the skills of MATLAB, etc.

17F13 - Reconstruction of rural ecological environment

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School

School of Mechanical
Engineering & Automation

SPECIALIZATION

One of my research directions is the re-construction of urban and rural ecological environment. Delivering such a project is mainly because young people in urban and rural areas are willing to work and live in big cities, which enlarges the population of big cities. On the contrary, the rural population is gradually decreasing, which leads to the lack of maintenance of agricultural land in part of the rural areas, even desertification of some farmland.

The purpose of this project is to re-design and re-construct rural villages and towns, to rebuild our homes by the restoration of ecological balance, attracting city dwellers to the countryside, even just for a short time.

PROJECT DESCRIPTION

This project consists of the following 9 parts:

- (1) re-design of rural towns
- (2) specific romantic, beautiful, practical rural ecological hut (courtyard) design
- (3) happy farm house (farm stay) and customer source re-planning and design
- (4) exploration of the design, operation and maintenance of rural tourism (travel inn)
- (5) children from urban to rural life experience planning (planting, breeding, restoring green space, etc.)
- (6) plan for city people self-driving, summer cooling, haze escaping, and the allocation for the required labor of rural ecological recovery

(7) according to chronological division, design reconstruction for rural villages and towns.

The reproduction and display of human habitation and life style on the scale of ten thousand years. These can be used as a historical education base, film and television venues etc.

(8) assessment of ecological restoration in rural areas

(9) research for the regional and global resource utilization and the distribution of rights and interests of waste gas emissions.

STUDENT ROLES

Students need to have a romantic sense, with a poetic passion to participate in design of a beautiful and practical ecological hut (courtyard) for rural China.

REQUIRED SKILLS

Students who are interested in this project should have strong and creative passion and good command of written and spoken English.

Hope to demonstrate your analytical and problem solving skills, team work spirit, skills of the 3D modeling design software or painting expression ability to show your design.

We are waiting for you!

17F14 - Online distribution of airline tickets

Supervisor

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School

School of Economics
and Management

SPECIALIZATION

Dr. TIAN is a full professor of Transportation Economics and head of the Department of Behavioral and Operations Management at Beihang University. He received his BSc and PhD degrees in Management Science from Beihang University. His research interests include travel behavior, transportation network modeling and optimization, and logistics. He has published more than 20 papers in peer-reviewed journals, such as Transportation Research Part B/C/E, Transportmetrica, Operations Research Letters.

PROJECT DESCRIPTION

In today' s digital world, airlines typically distribute tickets both via their own websites and through Online Travel Agency (OTA) platforms such as Expedia and Travelocity. Although associated with higher distribution costs, selling tickets through the platforms offers airlines exposure to a broader consumer base, and potentially higher sales than selling tickets solely through their own websites.

Our research discusses the behavior of airlines and OTA platforms for airline tickets selling. Particularly, how do airlines make decision between the single-channel approach and the multi-channel approach? What strategy will OTA platform make to achieve the greatest profit? Is there any possible for airlines and OTA platform to collaborate to make promotion or get the extra benefit?

The common processes and methods we do such researches are formulating economic models, numerical modeling and doing simulations and so on

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment, and will receive significant training on air transport management, economics and

mathematics. Specifically, the candidate will get familiar with the latest development of today' s airline market with regard to competition and collaboration of major air-ticket roles, learn how to describe an economic phenomenon using certain models with a better commend of economic and mathematic knowledge, be sensitive to data and get promotion in statistic analyzing and simulation practicing, etc.

REQUIRED SKILLS

Economics and Management, Mathematics and Statistics, Transportation, etc.

Students interested in this project should have a basic knowledge in economics and mathematics. Students in economics and management, mathematics and transportation usually have the necessary background. The project requires a strong work ethic and interest in learning new things in relevant fields.

17F15 - Sharing vehicle demand guiding and price strategy

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School

School of Economics and Management

SPECIALIZATION

Dr. TIAN is a full professor of Transportation Economics and head of the Department of Behavioral and Operations Management at Beihang University. He received his BSc and PhD degrees in Management Science from Beihang University. His research interests include travel behavior, transportation network modeling and optimization, and logistics. He has published more than 20 papers in peer-reviewed journals, such as Transportation Research Part B/C/E, Transportmetrica, Operations Research Letters.

PROJECT DESCRIPTION

Sharing vehicle has becoming an increasingly international hot issue with its significance in both environmentally friendly stuff and solving the last one mile problem. Many professors have made great progress in this field, which has paved the way for further exploring. Regardless of the past achievements in traditional sharing system in demand prediction, vehicle distribution, sharing network design, etc., new prospect has to be faced with the new concept of free-float sharing system.

Our research will focus on the deep relationship between price and demand guiding, and to build a reasonable model to describe their cause and effect. We tend to use statistic instruments like regression and simulation in dealing with existing data coming from those free-floating sharing system company to verify the feasibility of our project. Then initial model can be designed under some hypothesis. Those parameters will be rectified under practical consideration. With this idea, we try to explore a new way of solving the confliction between demand and supply, that is, price strategy. In this way, we can roll the sharing system under free-floating perspective more fluent.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in free-floating sharing system, and will receive significant training on micro- economics, transportation, statistics, etc. Specifically, the candidate will have an integrated comprehension on sharing vehicle system and can form characteristic findings based on personal academic interest.

REQUIRED SKILLS

Economics and Management, Mathematics and Statistics, Transportation, etc. Students interested in this project should have a basic knowledge in economics and mathematics. Students in economics and management, mathematics and transportation usually have the necessary background. The project requires a strong work ethic and interest in learning new things in relevant fields.

17F16 - Research on NYC Citi Bike system

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School

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SPECIALIZATION

Dr. TIAN is a full professor of Transportation Economics and head of the Department of Behavioral and Operations Management at Beihang University. He received his BSc and PhD degrees in Management Science from Beihang University. His research interests include travel behavior, transportation network modeling and optimization, and logistics. He has published more than 20 papers in peer-reviewed journals, such as Transportation Research Part B/C/E, Transportmetrica, Operations Research Letters.

PROJECT DESCRIPTION

Citi Bike presents a quick alternative to walking, taking a cab, or waiting for a crosstown bus. This bike sharing system offer an environment-friendly solution for the first-and-last mile connection and help bridge the gap between existing transportation modes such as subways and bus systems. And City Bike provides the raw data of history trip.

Our research will apply statistical knowledge and mathematical algorithm to analyze the data. And we want to study the bike rebalancing problem and the bike usage by different types of consumers.

STUDENT ROLES

The student will be actively engaged in working on data processing. Specifically, the candidate will learn how to programming and data mining.

REQUIRED SKILLS

Inorganic chemistry, and/or electrochemistry.

Students interested in this project should have a basic knowledge in urban transportation. The project requires a strong work ethic and interest in learning a range of transportation.

17F17 - Dynamic pricing for reservation-based parking system

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SPECIALIZATION

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PROJECT DESCRIPTION

With the population of urban vehicle, parking resources are becoming scarcer and scarcer. Additionally, the lack of parking information, unreasonable parking charging and uncertain parking demand aggravates parking problems. With the advent of the Internet era as well as the improvement of urban smart level, parking reservation has become one of the most effective ways to solve parking problems.

Our research proposes a dynamic pricing model allowing travelers reserving parking spaces through their personal smart equipment in advance. The parking system is operated by a private owner and her/his objective is to maximize the expected revenue. The revenue management method is adopted in setting the dynamic pricing policy of the reservation-based parking problem when trip demand is price sensitive and stochastic. Numerical experiments will be given to show that our optimal policy could save much cruising cost relative to traditional fixed price, which results in significant reduction in adverse socioeconomic externalities such as traffic jams and environmental pollution.

STUDENT ROLES

Firstly, the student will review literatures about revenue management and parking reservation. Secondly, the student will build a mathematical model to realize dynamic pricing for parking reservation. Thirdly, Numerical experiments will be designed to show the effectiveness of optimal policy. Finally, the student will analyze the contributions that our research makes to parking policy.

REQUIRED SKILLS

Microeconomics, mathematical modeling and programming ability (Matlab/C).

Students interested in this project should have a basic knowledge in mathematical modeling (Advanced Mathematics, Linear Algebra are necessary). Because of the necessary of numerical experiments, students have better to master programming ability, such as Matlab, C, C++ and so on. The project requires a strong work ethic.

17F18 - The market equilibrium and social welfare in taxi market with E-hailing applications

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SPECIALIZATION

Dr. TIAN is a full professor of Transportation Economics and head of the Department of Behavioral and Operations Management at Beihang University. He received his BSc and PhD degrees in Management Science from Beihang University. His research interests include travel behavior, transportation network modeling and optimization, and logistics. He has published more than 20 papers in peer-reviewed journals, such as Transportation Research Part B/C/E, Transportmetrica, Operations Research Letters.

PROJECT DESCRIPTION

In recent years, the taxi industry has been developed rapidly and taxi market with E-hailing applications has received considerable attention in the field of urban transportation. The emergence and popularity of e-hailing applications offers a new way for taxi drivers and passengers to communicate on line, which not only changes the behaviors of passengers and reduce the idle rate of taxi ,but also brings the cost of information for taxis and passengers.

Referring to the classic circular city model and combining with the characteristics of new way to taking taxis and the cost of information, we formulate the model of taxi market with e-hailing applications, which describes the behavior of passengers waiting for idle taxis and idle taxis cruising for un-served passengers. We provide an algorithm to simulate the model and obtained the stochastic steady-state results. Based on the results of simulations, we analyze the distributions of taxi utilization rate and passengers waiting time with or without using the e-hailing application, the queue of passengers and idle taxis and the gap time between two orders of the taxis. At the same time, we will find the equilibrium solutions to the model and focus on the properties of the

equilibrium solutions and social welfare, which varies with the changes of model parameters, such as the information quality, time value, subsidy for taxis or passengers and so on.

The findings will extend our knowledge of e-hailing applications, help to cognize the pros and cons of e-hailing applications objectively and offer the reference for decision making.

STUDENT ROLES

The student will be actively engaged in working on cutting-edge topics in a multi-disciplinary environment and will receive significant training on transport economics research, transportation planning and managements and transportation system modeling and analysis, especially user equilibriums and social optima in traffic systems. Specifically, the candidate will learn how to formulate the urban traffic model, solve the traffic model through mathematical method and computer application software and further to analyze the properties of a certain traffic model.

REQUIRED SKILLS

Transportation, and/or Economics, and/or Managements.

Students interested in this project should have a basic knowledge in operational research or mathematical programming, microeconomics and transportation planning and managements. Students in transportation, economics or managements usually have the necessary background. The project requires a strong work ethic and interest in transportation research.

17F19 - Cellular automaton model for traffic flow

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SPECIALIZATION

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PROJECT DESCRIPTION

Cellular automata (CA) were historically proposed in the 1940s (Neumann, 1948) and popularized in the 1980s (Wolfram, 1983) to accurately reproduce macroscopic behavior of a complex system using minimal microscopic descriptions. And it has been frequently applied in various fields, including traffic flow modeling. Several notable traffic CA (TCA) models were developed for reproducing CF & LC behaviors, such as single-cell models, multi-cell models and so on.

Our project is to research on different kinds of TCA models holding different hypothesis and to find out the linkage between different TCA rules and macroscopic traffic flow characteristics.

STUDENT ROLES

The student will be engaged in working on topics about TCA models in a multi-disciplinary environment, and will receive significant training on operations research, travel behavior analysis, and math. Specifically, the candidate will not only have a good command of the TCA models, but also learn how to use cellular automata to reproduce macroscopic behavior of a complex system in various other fields using minimal microscopic descriptions.

REQUIRED SKILLS

Students interested in this project should have a basic knowledge in microeconomics and have basic programming ability.

17F20 - Solving natural language processing tasks via deep learning techniques

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School

School of Computer
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SPECIALIZATION

My research focuses on the machine learning, data mining and information retrieval. Specifically, my research team are mainly centered on the following topics:

- (1) The theory and algorithms of deep learning
- (2) Natural language processing
- (3) Human Computer collaborative computing
- (4) Social network analysis

PROJECT DESCRIPTION

Machine learning algorithms are widely used in the Natural Language Processing tasks, such as Parsing, Named Entity Recognition (NER), Relation Classification, and Sentiment Analysis. These existing approaches highly dependent on human designed representations and features. Recently, with the development of deep learning, researchers are able to discover features and representations automatically. The algorithms, such as RNN, LSTM and Sequence2Sequence model outperforms the traditional machine learning algorithm on the NLP tasks in a large margin.

STUDENT ROLES

The goal of this project is to grasp the skills of utilizing Deep Learning models to build deep learning based models to solve real-life problems. In this project, students will learn the basic ideas and models of deep learning and the deep learning developing frameworks (Torch, Theano or TensorFlow). The distributed representation model for vector representations for phrases and sentences will be studied and be implemented. Several traditional NLP tasks, NER, sentiment analysis and

sentence completion, will be studied and these tasks are required to be implemented by deep learning models.

REQUIRED SKILLS

Basic machine learning knowledge, programming language (Python)

17F21 - Experimental and theoretical studies of indoor submicron particle agglomeration in electrostatic apparatus

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SPECIALIZATION

My research focuses on air pollution control theories and technologies. Specifically, our research interests are mainly centered on three topics:

(1) Micro environmental air quality control: the origin of the indoor air quality problems, the characteristics of indoor air pollution and health effects; indoor air purification control methods including electrostatic precipitation, plasma purification technology; Characteristics and relationships between indoor and outdoor O₃

(2) Multiple pollutions collaborative control technologies: measures for simultaneous desulfurization, denitrification, dioxins and heavy metals removal in iron and steel industry

(3) Energy audit and industrial energy saving measures

PROJECT DESCRIPTION

In order to improve capture efficiency of traditional filter for indoor PM 2.5, the agglomeration of charged particles in electric field could be introduced. The basic idea to fight against emission of fine particles is to increase their mean size before precipitation. Agglomeration is a process in which small particles come together (coagulate) to form a larger one, or in which small particles adhere to a larger one.

Our research will apply agglomeration as a pre-process on indoor air quality control to improve the capture efficiency of traditional filters for indoor PM 2.5. The possibility and development direction of the indoor application of electric agglomeration would be analyzed.

The proposed research project is to fabricate new types of electric coagulation indoor air cleaning system, and a series of comprehensive experiments could be constructed by using fly ash as test dust. We would do research on the numerical stimulation of air flow distribution under different conditions by CFD analysis software. Finally, select the best combination of particle precipitation conditions and try to illuminate the experimental properties of electrostatic agglomerators.

STUDENT ROLES

The student will be actively engaged in working on indoor air pollution control topics in a multi-disciplinary environment, and will receive significant training and be capable of developing devices and artifacts able to monitor, measure, model and control environmental impact. Specifically, the candidate will learn how to use this air pollution control technology to capture submicron particle and improve indoor air quality; how to analyze the relation between different factors in the electric field, such as voltage, electrode distance, electrode valence; how to perform particle moving characterizations in electric field, including CFD numerical simulation, flow measurement and analysis, etc.

REQUIRED SKILLS

Students in chemistry, physics or environmental engineering usually have the necessary background. The project requires a strong work ethic and interest in learning a range of instrumentation. Basic knowledge on air quality control. Interest in learning CFD analysis software.