# Intern Research Topics

| Number | P1 |
|---|---|
| Project title： | Nanotechnology on batteries and supercapacitor |
| Description of the research | Synthesis of carbon-based nanomaterials for the use of battery specially, lithium ion battery, metal air battery or supercapcitor. Students are required for the experiments of the material synthesis, characterization and battery applications. |
| Mentor in CCU | Prof. Yuan-Yao Li<br>Dept. of Chemical Engineering,<br>National Chung Cheng University, Taiwan.<br>(chmyyl@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 8 weeks |
| Category | ☐ A: Scholarship<br>■ B: Self-supported |

| Number | P2 |
|---|---|
| Project title： | Study on the topics of biochemical engineering and biomedical sciences |
| Description of the research | This project aims to recruit undergraduate and postgraduate students from the universities in South and Southeast Asian countries to CCU laboratories for technical training and short-team research. Topics of research cover biochemical engineering (applied microbiology, enzyme engineering, protein expression and large-scale production), systems biology, metabolic network simulation, cancer epigenomics, and neurodegenerative diseases.<br>Each student can choose one of those topics and work on a laboratory in either the Department of Chemical Engineering or the Department of Biomedical Sciences. |
| Mentor in CCU | Prof. Wen-Chien Lee<br>Dept. of Chemical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(chmwcl@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 7 weeks between March 1 and Aug. 31 |
| Category | ■ A: Scholarship<br>■ B: Self-supported |

| Number | P3 |
|---|---|
| Project title： | RFIC Design, 5G Beamforming Technology and Thru-wall Impulse Radar |
| Description of the research | The research topics include Radio-Frequency Integrated Circuit Design,5G Beamforming Related Technologies, and Through-wall Impulse Radar Hardware/Signal Processing.<br>It not only handles with hardware, but also integrates with the knowledge of signal analysis. The students who are familiar one of the skills such as matlab programming or instrument data extraction tool are preferred. |
| Mentor in CCU | Associate Prof. Janne-Wha Wu<br>Dept. of, Communications Engineering<br>National Chung Cheng University, Taiwan, ROC.<br>(e-mail:) jwwu@ccu.edu.tw |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 8 weeks |
| Category | ☐ A: Scholarship<br>■ B: Self-supported |

| Number | P4 |
|---|---|
| Project title： | Implementation of evaluation scenario in 5G/B5G communication of IMT-2020 |
| Description of the research | This project is to build topologies and derive environmental channel conditions in several generally accepted scenarios which contain focused 5G/B5G challenges in the IMT-2020, such as very high data rate, high reliability, low latency and very dense crowds. These scenarios include indoor offices, dense urban environment, and urban macro base stations. In this intern, you will learn performance evaluation and visualization of future 5G/B5G communication systems in IMT-2020. |
| Mentor in CCU | Prof. Jen-Yi Pan<br>Dept. of Communications Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(e-mail: jypan@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 3 months between March 1 and Aug. 31 |
| Category | ☐ A: Scholarship<br>■ B: Self-supported |

| Number | P5 |
|---|---|
| Project title： | Visual and skeleton-based action recognition based on deep learning approach |
| Description of the research | This research is to recognize human's action (stand, walk, run, fall-down, talking, etc.) from the single-view video or skeleton data. Our approach will be based on machine learning techniques such as CNN, RNN, or LSTM (deep learning). This technique is useful in video surveillance or health care center to monitor persons' daily life. The intern student is expected to have some preliminary knowledge on NN (neural network) or deep learning and skilled in C/C++ or Python programming. He/She will learn how to apply state-of-the-art deep learning techniques to solve the indicated problems. |
| Mentor in CCU | Prof. Wen-Nung Lie<br>Dept. of Electrical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(ieewnl@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least **8 weeks** between March 1 and Aug. 31 |
| Category | ■ A: Scholarship **(partial, 50%~100%)**<br>■ B: Self-supported |

| Number | P6 |
|---|---|
| Project title： | Content-aware 360 degree video coding |
| Description of the research | This research is about the 360 degree video coding system. Capturing the scene and representing it with efficient panoramic images will be first addressed. Then a saliency video is generated and served as a guidance for efficient 360 degree video coding to offer high quality video. In this summer internship, the intern not only learn C/C++ programs to implement the proposed techniques, related deep learning platform is also accessed. |
| Mentor in CCU | Prof. Jui-Chiu Chiang<br>Dept. of Electrical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(rachel@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>■ Third/forth-year undergraduate senior student<br>☐ Both |
| Intern period | At least 12 weeks between March 1 and Aug. 1 |
| Category | ■ A: Scholarship<br>■ B: Self-supported |

| Number | P7 |
|---|---|
| Project title： | Saliency-driven Tone Mapping for HDR Image Display Using Deep Learning |
| Description of the research | This research is about the tone mapping (TM) technique. To enable the display of HDR image on the conventional device, TM technique is needed. TM techniques will preserve the details of the HDR image as much as possible while allowing pleasing visual experience. To better retain the details of the HDR image, a saliency driven TM is investigated in this research. In addition, the derived TM model is generated based on a deep learning architecture. |
| Mentor in CCU | Prof. Jui-Chiu Chiang<br>Dept. of Electrical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(rachel@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>■ Third/forth-year undergraduate senior student<br>☐ Both |
| Intern period | At least 12 weeks between March 1 and Aug. 1 |
| Category | ■ A: Scholarship<br>■ B: Self-supported |

| Number | P8 |
|---|---|
| Project title： | Important Issues for Renewable Generation Integration into Power Systems |
| Description of the research | This research is to understand important issues for the impact of high penetration of renewable generation integration on power system operations and the corresponding strategies to reduce the risks, such as renewable power forecasting, inertia control, power system modeling, energy storage system, generating unit scheduling, and power system stability. |
| Mentor in CCU | Prof. Yuan-Kang Wu<br>Dept. of Electrical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(allenwu@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 12 weeks between March1 and Aug. 31 |
| Category | ■ A:Scholarship<br>■ B: Self-supported |

| Number | P9 |
|---|---|
| Project title： | Thermal characterization for atmospheric-pressure microsecond pulsed helium discharges |
| Description of the research | Atmospheric-pressure helium plasmas have been developed extensively in the last two decades for various biomedical applications such as wound healing, cancer treatment, and sterilization due to the efficient generation of reactive species. Discharge temperature is one of the major concerns for applications with discharge treating human tissues. This project will conduct thermal analysis for an atmospheric-pressure microsecond pulsed helium discharges including experimental measurements and numerical simulations. The temperature distribution of the reactor surface will be measured via the the rotational spectra (i.e., $N_2(C \rightarrow B)$) collected by the spectrometer. A computational fluid dynamic (CFD) model will be built with the heating source evaluated by the plasma fluid model to simulate the temperature distribution within the reactor. The simulated results will be validated and the plasma heating mechanisms will be studied. |
| Mentor in CCU | Prof. Kun-Mo Lin<br>Dept. of Mechanical Engineering<br>National Chung Cheng University, Taiwan, ROC.<br>(e-mail: imekml@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 2 months between March 1 and Aug. 31 |
| Category | ■ A: Scholarship<br>■ B: Self-supported |

| Number | P10 |
|---|---|
| Project title： | Study on the effect of configuration of electrolyte piping system on the shunt currents distribution of an all-vanadium redox flow battery |
| Description of the research | In this study, mathematical models of equivalent electricity circuits will be developed to study the effect of configurations of electrolyte piping system on the shunt currents of an all-vanadium redox flow battery (VRFB).<br>Students need to understand the principle of VRFB and factors that influence shunt currents in a VRFB. Students need to be familiar with Matlab, matrix operation, Kirchhoff's law, and complicated loop operation. |
| Mentor in CCU | Prof. Yong-Song Chen<br>Dept. of Mechanical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(e-mail: imeysc@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 8 weeks between March 1 and December 31 |
| Category | ■ A: Scholarship<br>■ B: Self-supported |

| Number | P11 |
|---|---|
| Project title： | Friction Stir Additive Manufacturing (FSAM) Process |
| Description of the research | This work focuses on a development of a solid state welding and additive manufacturing technique by applying the friction stir welding to 3D solid state friction stir additive manufacturing (FSAM) to attain microstructure refinement and structural integrity and efficiency. The scope of this work for the summer interns includes equipment modification, innovative jig & fixture design, new tool design for lap stir joint of stacked layers of sheet metal combination, setup of parameter-windows, microstructure study and materials test. |
| Mentor in CCU | Prof. Jong-Ning Aoh<br>Dept. of Mechanical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(imejna@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both<br>Note: students who will graduate in 2020 will not be considered |
| Intern period | At least 2 months between **JUNE 20** and Aug. 31. In special case, maximum 3 months. |
| Category | ■ A: Scholarship<br>■ B:Self-supported |

| Number | P12 |
|---|---|
| Project title： | Bobbin Friction Stir Welding process development |
| Description of the research | This work focuses on a development of a solid state welding process with self-supporting stir tool. The scope of this work for the summer interns includes equipment modification, innovative jig & fixture design, new tool design for lap stir joint of stacked layers of sheet metal combination, setup of parameter-windows, microstructure study and materials test. |
| Mentor in CCU | Prof. Jong-Ning Aoh<br>Dept. of Mechanical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(imejna@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both<br>Note: students who will graduate in 2020 will not be considered |
| Intern period | At least 2 months between **JUNE 20** and Aug. 31. In special case, maximum 3 months |
| Category | ■ A: Scholarship<br>■ B:Self-supported |

| Number | P13 |
|---|---|
| Project title： | Interdisciplinary opto-mechanical integration |
| Description of the research | Our research is mainly for cross-domain integration research, such as integration of semiconductor solar photovoltaic components and single-cell biochips, to achieve self-powered biochips, integration of various micro-nano process technologies such as laser interference lithography, anodized aluminum, nano Imprinting technology on solar cells, light-emitting diode components and the development of novel optical analysis techniques on two-dimensional materials, in the study of cross-domain integration, the study of basic physical mechanisms is very important, such as electronic hole pairs The relationship between transmission and the polarity of cancer cells, the mechanism of the surface microstructure of the surface for the generation of surface plasma waves, and the interaction between the atomic layer and the atomic layer in two-dimensional materials. These basic mechanisms involve physics, chemistry, materials, optics and other related fields. Interactions, and there are still many unclear issues on the subject of these studies. If you can further solve these mysteries, you can make a considerable contribution to both basic science and engineering. |
| Mentor in CCU | Prof. Hsiang-Chen Wang<br>Dept. of Mechanical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(hcwang@ccu.edu.tw) |
| Expected student level | ■ Post-graduate student<br>□ Third/forth-year undergraduate senior student<br>□ Both |
| Intern period | At least 8 weeks between March 1 and August 31 |
| Category | ■ A: Scholarship<br>■ B:Self-supported |

| Number | P14 |
|---|---|
| Project title： | Design of intelligent vision system for mobile robots |
| Description of the research | This research is to design an intelligent vision system for mobile robots. The RGB-D camera is installed on the forehead of the robot, which can move to perform tasks such as video surveillance. You can design image processing/pattern recognition techniques to detect intruders, abnormal events, or to navigate in environments with obstacles. This vision system will be a key technology for Industry 4.0, where intelligent robots will be popular in our daily life. In this summer intern, you will learn how to write C/C++ or Python programs for image processing/pattern recognition, and learn how to control the mobile robots. Hopefully, you can learn how to use deep learning techniques. |
| Mentor in CCU | Prof. Wen-Nung Lie<br>Dept. of Electrical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(ieewnl@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least **8 weeks** between March 1 and Aug. 31 |
| Category | ■ A: Scholarship **(partial, 50%~100%)**<br>■ B: Self-supported |

| Number | P15 |
|---|---|
| Project title： | Effect of ON/OFF operation on the durability of a proton exchange membrane fuel cell |
| Description of the research (within 300 words) | Repeat start-up and shut down of a proton exchange membrane fuel cell cause the degradation of the performance. To understand the degradation phenomena of the membrane electrode assemblies during on/off operation, the catalyst layer will be analyzed.<br>Students need to understand the principle and configuration of fuel cells before coming to CCU. In this project, students need to use DAQ to control and measure the performance of a fuel cell. The morphology of the catalyst will be observed by SEM. |
| Mentor in CCU | Prof. Yong-Song Chen<br>Dept. of Mechanical Engineering,<br>National Chung Cheng University, Taiwan, ROC.<br>(e-mail: imeysc@ccu.edu.tw) |
| Expected student level | ☐ Post-graduate student<br>☐ Third/forth-year undergraduate senior student<br>■ Both |
| Intern period | At least 8 weeks between March 1 and December 31 |
| Category | ■ A: Scholarship<br>■ B: Self-supported |