Chou-Wei Kiang

cwjkiang@outlook.com ♦ https://cwjkiang.github.io/ ♦ Google Scholar ♦ Linkedin

Education

National Taiwan University (NTU), Taipei, Taiwan — September 2018 – June 2022

- Bachelor of Science in **Electrical Engineering (EE)**
- GPA: **4.24/4.3**, ranked **top 4% (7/196)**
- Honor: NTUEE graduation ceremony representative, top 10 in the class of 2022
- Award: NTU Presidential Award, Fall 2018

Taipei Municipal Chien-Kuo Senior High School, Taipei, Taiwan — September 2015 – June 2018

- Vice-Chairman (two terms) of Student Association, February 2016 – January 2017

Peer-Reviewed Journal Articles

[1] **Chou-Wei Kiang** and Jean-Fu Kiang, "Imaging on underwater moving targets with multistatic synthetic aperture sonar," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 60, Nov. 2022, Art. no. 4211218, [pdf] [IEEE Xplore].

[2] **Chou-Wei Kiang** and Jean-Fu Kiang, "Imaging and motion parameter estimation of flying helicopter with duo airborne SARs in X-Band," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 15, pp. 9623-9638, Nov. 2022, [pdf] [IEEE Xplore].

Journal Manuscript in Preparation

[3] **Chou-Wei Kiang** and Jean-Fu Kiang, "Radiation force of Gaussian beam on spherical particles with Fourier transform, Lorenz-Mie theory and Maxwell stress tensor, " *in preparation*, 2022, [pdf].

Research Interests

Electromagnetic simulations and applications, optics and photonics, quantum physics and engineering, applied physics, signal processing, remote sensing, radar and sonar imaging, communication systems

Research Experiences

Undergraduate Research Assistant — June 2020 – June 2022

Research Assistant — June 2022 – present

Group of Electromagnetic Applications, Department of Electrical Engineering, NTU
Advisor: Prof. Jean-Fu Kiang

- Synthetic aperture sonar (SAS) for **remote sensing** [1]
  - first article to present a complete procedure and rigorous formulation for SAS imaging of moving submarine
  - propose multistatic SAS configuration to estimate velocity vector of moving submarine within 3% of error
  - propose modified range Doppler algorithm to acquire SAS image from echoed signals by integrating range frequency reversal transform, modified second-order Wigner-Ville distribution transform and Radon transform
- SAS imaging of moving target with nonlinear motion for **remote sensing**
  - deriving a rigorous model for SAS imaging of moving target with nonlinear motion such as acceleration
  - developing new SAS imaging algorithm to properly compensate for higher-order phase error due to target acceleration
  - developing novel multistatic SAS configuration to estimate both velocity and acceleration of the moving target
- Synthetic aperture radar (SAR) for **remote sensing** [2]
  - first article to present an effective procedure and rigorous formulation to acquire SAR image of moving helicopter
  - propose a two-stage template matching to separate backscattered signals from fuselage and fast-spinning rotors
  - propose duo airborne SAR configuration and phase matching transform to estimate target velocity within 0.03% of error
  - propose an angular spectrum to accurately estimate the rotor spin rate
- Optical radiation force in **optics and electromagnetics** [3]
  - integrate Fourier transform for decomposing an incident Gaussian beam, Lorenz-Mie theory for computing scattered fields, and Maxwell stress tensor for computing the radiation force exerted on a spherical particle
  - demonstrate the distributions of electric field and radiation force density on a spherical surface enclosing the particle, as well as the net time-average radiation force exerted with different Gaussian-beam waists
  - simulate and discuss the oscillation phenomenon in radiation force of an incident Gaussian beam on a spherical particle
- Orbital angular momentum (OAM) in **optics and electromagnetics**
  - conducting numerical simulations to investigate the properties of several OAM beams, including Laguerre-Gaussian beam, perfect vortex beams, and higher-order Poincaré sphere beams
  - exploring potential and novel applications of OAM in radar and sonar imaging, optical and quantum communication
- Network traffic forecasting in **satellite communication systems** with **artificial intelligence**
  - building model and simulation scenario for demanded traffic of satellite-ground links in a satellite mega-constellation
  - developing forecasting algorithm based on spatial-temporal neural network by integrating LSTM, GRU, and CNN

Selected Courses (Straight A)

∗ graduate level courses (straight A+) are underlined

Electomagnetics and Optics (straight A+)

- Optoelectronic Electromagnetics
- Fourier Transform and Fourier Optics
- Electromagnetics I, II
- Fundamental of Electro-Optics
- Electrical Engineering Lab. (Photonics)
- RF Microwave Wireless Systems

Signal Processing and Communications

- Time-frequency Analysis and Wavelet Transform
- Signals and Systems
- Principle of Communications
- Electrical Engineering Lab. (Communication System)

Mathematics

- Selected Topics in Engineering Mathematics
- Differential Equation
- Probability and Statistics
- Linear Algebra
- Calculus I, II
- Discrete Mathematics

Physics and Mechanics (straight A+)

- Solid-State Electronics
- Modern Physics
- Thermodynamics
- Fluid Mechanics
- General Physics I, II
- General Physics Lab. I, II
- Applied Mechanics

Electronics and IC design

- Integrated Circuit Design
- Electronics I, II
- Electronics Lab. I, II
- Electronic Circuits and Lab.
- Switching Circuit and Logic Design

Other Engineering Related Courses

- Algorithms
- Computer Programming and Lab.
- Principles and Applications of Microcontrollers
- Engineering Drawing and Computer-Aided Design
- General Chemistry and Lab.
- Biology for Engineers

Selected Course Projects

Autofocus Methods for Synthetic Aperture Radar (SAR) Imaging Spring 2022

Term paper for Fourier Transform and Fourier Optics, [pdf]

- investigate and derive phase gradient autofocus (PGA) and minimum entropy autofocus (MEA) algorithms
- implement PGA and MEA with Matlab on blurred point targets and blurred image acquired from real SAR data

DWT and DTCWT for Image Processing Fall 2021

Term paper for Time-Frequency Analysis and Wavelet Transform, collaborated with S.-Y. Chang

- thoroughly compare discrete wavelet transform (DWT) and dual-tree complex wavelet transform (DTCWT)
- implement image denoising and image compression with DWT and DTCWT under different wavelet designs

Double-Stub Impedance Matching Simulation Spring 2020

Simulation project for Electromagnetics II, collaborated with S.-H. Pan, [demo]

- derive double-stub impedance matching theory with 9 phasors and 9 boundary conditions
- simulate voltage and current variation with time on the main transmission line and both stubs with Matlab

Digital Integrated Circuit (IC) Design of an Image Processing Filter Spring 2021

Term project for Integrated Circuit Design, collaborated with Y.-C. Liu

- design IC circuit with Verilog to perform pixelwise census transform and median filter on an input image
- implement pipeline design to improve area-time (AT) performance
- simulate an entire design flow, including register transfer level (RTL) design, synthesis, and auto-place and route (APR)

Smart IoT Platform for Bicycle Sharing and Management Fall 2021

Term project for Computer Programming, collaborated with C.-T. Wang and Y.-C. Liu

- build a prototype of bicycle sharing/borrowing website and back-end database with HTML/CSS and Python Django
- implement an interactive smart lock system by integrating NFC/RFID, GPS module, and motor with Raspberry Pi

Skills

Programming: **proficient in** Matlab, Python, C/C++; **familiar with** Verilog
Others: **proficient in** LaTeX, Tensorflow, Visio; **familiar with** Linux, Git, Raspberry pi, Meshlab, Solidworks
Languages: English, Mandarin Chinese