Zhou Jiang | Mechanical Engineering Postgraduate

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Professional Profile

"A mechanical engineering master student with a passion for optics & biomedical optical microscopy and a strong academic background in optical instrument design & manufacture & alignment & calibration, photoelectric signal processing, and noises/errors analysis."

Devoted to the development and application of the high-precision optical measuring instrument. Studied systematically in polarized (applied) optics, geometric optics, physical optics, ellipsometry, and metrology. Experienced in optomechanical system design and manufacture, optical signal processing, mathematical modeling, and the use of various related software. Possess the capacity to support the team with the construction of complex optical experimental platforms. Committed to continuous learning and professional development, with a genuine interest in optics & biomedical optical microscopy.

Core Skills

- Opto-mechanical Design & Manufacture & Installation & Adjustment
- Data Acquisition System Construction
- Numerical Simulation - Virtual Instrumentation based on *Matlab*
- Applied Optics & Optical Design
- Signal & Error Analysis of Optical System
- English Writing Ability
- Software: Matlab, Zemax, Virtuallab Fusion, Labview, Solidworks, Anasys, C-language, Office, etc.
- English: IELTS 6.5 (Listening 6.0, Reading 6.5, Writing 6.5, Speaking 6.0) [Temporary Score]

Education

M.S. **Mechanical Engineering**
GPA: 86.29/100
Huazhong University of Science and Technology (HUST), China, 09/2019 - 06/2022

Thesis: "Development of Single-Wavelength Dual-Rotating Mueller Matrix Ellipsometer".
The Best Graduation Thesis, Ranking 1st, Score = 94.8 / 100

Modules: Opto-mechanical / Optics / Ellipsometry / Metrology / Polarization / Errors / Signal Analysis
Advisor: Prof. Hao Jiang
Group: Nanoscale and Optical Metrology (NOM) Group

B.S. **Mechanical Engineering**
GPA: 87.65/100, Rank: 19/488 (Top 4%)
Northeastern University (NEU), China, 09/2015 – 06/2019

Thesis: "Structure Design and Process Research of Small Five-axis Linkage Machine Tool based on CNC System".
2019 Outstanding Graduation Thesis of Northeastern University, Ranking 1st, Score = 96.0 / 100

Modules: Structure Design / CNC / Machine Tool / Machining / Multi-axis Motion
Advisor: Prof. Lida Zhu

Internships

Aug. 2020 - Nov. 2020 **Thin-Film Analyst**
Wuhan Eoptics Technology Co., Ltd

Outline
Undertook a short-term assignment pertaining to the thin films' spectroscopic measurements to test the performance of newly developed spectroscopic ellipsometry; reported to the Executive Engineer.

Key Responsibilities
- Ultra-thin film measurement and data processing.
- Produce comprehensive reports on the operating manual and the code comments.

Oct. 2019 - Nov. 2019 **System Engineer**
Shanghai Precision Measurement Semiconductor Technology Co., Ltd

Outline
Undertook a short-term assignment pertaining to the multi-wavelength dual-rotator Muller matrix ellipsometry; reported to the Executive Engineer.

Key Responsibilities
- The critical component selection of the multi-wavelength dual-rotator Muller matrix ellipsometry
- Specification and conversion of the Matlab code

Jul. 2018 - Aug. 2018 **Internship**
Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Science

Key Responsibilities

- The structure design of an infrared detector

Oct. 2018 - Nov. 2018 **Internship**
Shenyang Machine Tool (Group) Co., Ltd

Key Responsibilities

- The structure design of a horizontal machine tool

Appointments

Oct. 2020 - Jan. 2021 The teaching assistant in the course “The C++ Programming Language”.
Mar. 2020 - Jun. 2020 The teaching assistant in the course “Basic Control Principle of Mechanical Engineering”.
Oct. 2017 - Jan. 2018 The teaching assistant in the course “Experiments of Mechanical Design”.

Achievements

Published 1 SCI paper in a high-quality journal. Prepare to Submit 2 SCI papers. All these SCI papers are the First author. Applied 3 national innovation patents (Authorized: 1). Attended 4 international/domestic conferences. Invited reports: 2 times.

Research Topic

- Characterization and Measurement of Thin Film
- System Calibration of Ellipsometer
- Geometric Optical Simulation of Ellipsometer
- Design and Construction of Polarimeter and Ellipsometer
- Signal and Noise Processing
- Systematic Error and Random Error Study of Ellipsometer

Research Projects and Experience

Jan. 2020 - Present **Key Research Team Member**
Huazhong University of Science and Technology

Project Information

“Development of High-Precision Single-Wavelength Mueller Matrix Ellipsometer System for IC Manufacturing”
Supported by the HUST – PMISH (Shanghai Precision Measurement Semiconductor Technology) Cooperative Project
CNY 1,250,000
Period: Jan. 2020 - Dec.2021

Outline

Develop a single-wavelength Mueller matrix ellipsometry to provide measurement and characterization for nanotechnology and nanomanufacturing in the semiconductor IC industry, OLED industry, PV industry, etc.

Key Responsibilities

- Verification of measurement principles & Critical components selection
- Numerical modeling of the measurement system & Calibration for the optical system
  Use *Matlab* to build a virtual instrument based on *Matlab* code;
- Optical system design & Simulation
  Use *Zemax* (Geometric Optics) and *Virtuallab Fusion* (Physical Optics) to build an optical model;
- Opto-mechanical design and manufacture & Precision alignment of the optical system
  Use *Solidworks* to design the optomechanical system (High precision alignment, Micro-spot lens holder, etc.);
- Formulation of systematic/random error propagation and estimation
  Use *Matlab* to build an error propagation model and analyze the individual effects of different error sources;
  Propose a set of system optimization methods;
- Construction of a data acquisition system
  Use the *NI DAQ* card and *Labview* to build a real-time data acquisition system;
- Signal and noise processing & Sample measurement & data processing

Key Academic Achievements

- How to improve the repeatability precision of the instrument when various random errors exist in the optical system?
  Propose a random error propagation model and observe the impacts of errors;
  Propose the optimization methods according to the error propagation equation and find the best system configuration;
  Propose a Peaking-Matching algorithm for the bias of trigger signal;
- How to get accurate calibration and measurement results when the light is incident obliquely due to the widespread imperfections in manufacture, installation, and adjustment?
  Propose a characterization model of the waveplate for calibrating the system parameters when the light is at tilt incidence;
  Propose a calibration method to decouple systematic errors when the light is at tilt incidence;
- How to get the correct measurement results when the additional polarization effects caused by the lens pair exist in the instrument system?
  Propose a phenomenological model based on the Mueller matrix decomposition, in which the lens pair is optically equivalent to a cascade system;

Oct. 2019 - Nov. 2019 **Research Team Member**
Huazhong University of Science and Technology

Project Information

"In-situ Metrology of Complex Nanostructure Self-Assembling Based on Mueller Matrix"
Supported by the National Natural Science Foundation of China (Grant No. 51975232)
CNY 600,000
Period: Jan. 2020- Dec.2023

Outline

Explore the optical characteristic modeling for self-assembled materials, the principle of complex nanostructure self-assembling metrology based on Mueller matrix and its decomposition, and the corresponding experimental demonstration.

Key Responsibilities

- Participate in optical system design of a six-channel Stokes polarimeter;
- Participate in the assembly, calibration, and optimization of a six-channel Stokes polarimeter;
- Participate in the measurement of liquid crystal variable retarders and birefringent crystal;

Jan. 2017 - May. 2018 **Primary Contact & Project Leader**
Northeastern University

Project Information

"Optimization of Additive and Subtractive Manufacturing Process based on CNC"
Supported by the National Innovative Training Program of College Students (Grant No. 170062)
CNY 25,000
Period: Jan. 2017- May.2018

Outline

Develop a small 5-axis machine tool for additive and subtractive processing based on a CNC system, which can simplify the process and broaden the processing range for customization production.

Key Responsibilities

- The mechanical structure design of the five-axis CNC machine tool
  Principle design, structural design, manufacturing, and assembly
- Mathematical modeling and simulation calculations of five-axis CNC machine tool
  Trajectory planning, optimization, and control for CNC machine tool
- Calculation of loads and components selection of machine tool
- Coordination and project management
- Study the process of 3D printing (additive) and milling (subtractive) for different materials

Key Achievements

- developed a seven-axis five-linkage machine tool for additive (3D printing) and subtractive processing based on CNC system
- Produce a design manual of the small 5-axis machine tool
- Produce an operation manual for a seven-axis five-linkage machine tool

Mar. 2017 - Jul. 2018 **Key Research Team Member**
Northeastern University

Project Information

"A One-Handed Auxiliary Artificial Fruit Picking Tool"
Supported by the National College Students Mechanical Innovation Design Competition Project
CNY 10,000
Period: Mar. 2017- Jul. 2018

Outline

Developed a fruit picking tool that can be held in one-hand at a very low cost, which can reduce the workers' fatigue.

Key Responsibilities

- Mechanical structure design and manufacturing
- Design specification writing

Publications

Overall Profile

1 peer-reviewed journal, 2 submit-prepared peer-reviewed journals, 4 conference reports, 3 innovation patents

Journal Papers

[1] **Zhou Jiang**, Song Zhang, Jiaming Liu, Qi Li, Hao Jiang, Shiyuan Liu, "Error Analysis for Repeatability Enhancement of a Dual-Rotation Mueller Matrix Ellipsometer," ***Front. Phys.*** 9:820552, Jan. 2022. doi: 10.3389/fphy.2021.820552 (2021). (IF = 3.563)

[2] **Zhou Jiang**, Hao Jiang, Song Zhang, Shiyuan Liu, "In-situ calibration of retardance fluctuation error of waveplate in Mueller matrix ellipsometer," 2022. (*Prepare for Submission*)

[3] **Zhou Jiang**, Jiaming Liu, Song Zhang, Hao Jiang, Shiyuan Liu, “In-situ calibration of polarization effects of the focusing lens in the micro-spot Mueller matrix ellipsometer,” 2022. (*Prepare for Submission*)

Conference Reports

[1] Jiamin Liu, **Zhou Jiang** (Co-first author), “In-situ calibration of polarization effects for the focusing lens in the micro-spot Mueller matrix ellipsometer,” presented in “*International Computational Imaging Conference: Technology and Application (CITA2021)*”, Hangzhou, China, Sep 24-26, 2021.

[2] **Zhou Jiang**, Lin Zhang, Song Zhang, Jiamin Liu, Qi Li, Hao Jiang, Shiyuan Liu, “Error analysis for repeatability enhancement of a dual-rotation Mueller matrix ellipsometer,” presented in “*2021 IEEE International Conference of Optical Imaging and Measurement (IEEE ICOIM 2021)*”, Xian, China, Aug 27-29, 2021.

[3] **Zhou Jiang**, Song Zhang, Jinsong Zhang, Hao Jiang, Shiyuan Liu, “Development of a high-precision Mueller matrix ellipsometer for in-situ monitoring of film thickness,” presented in “*The 18th National Optical Testing Academic Exchange Conference*”, Wuxi, China, Nov 27-30, 2020.

[4] **Zhou Jiang**, Song Zhang, Tao Huang, Hao Jiang, “Study of the calibration method of optical elements in a high-precision Mueller matrix ellipsometer,” presented in “*The 4th Optical Young Scientists Forum (OYSS 2020)*”, Ningbo, China, Dec 04-07, 2020.

Theses

[1] **Zhou Jiang**, “Development of Single-Wavelength Dual-Rotating Mueller Matrix Ellipsometer,” M.S. thesis, Huazhong University of Science and Technology, Jun. 2022.

[2] **Zhou Jiang**, “Structure Design and Process Research of Small Five-axis Linkage Machine Tool based on CNC System” B.S. thesis, Northeastern University, Jun. 2019.

Patents

[1] Lida Zhu, **Zhou Jiang**, Dongxiao Song, Ye Wang, Haoyu Ma, A small five-axis CNC machine tool for additive or subtractive machining. (Chinese innovation patent, Number: CN108127917A)

[2] Lida Zhu, Dongxiao Song, **Zhou Jiang**, A seven-axis five-linkage CNC machine tool motion control system for additive and subtractive processing. (Chinese innovation patent, Number: CN109270893A)

[3] Yu Zhang, Haoyu Yin, **Zhou Jiang**, Zirun Wang, Qifeng Zeng, A manual fruit picking device. (Chinese innovation patent, Number: CN108834570B)

Honors & Awards

Oct. 2021	Best Paper Award Certificate at the IEEE International Conference of Optical Imaging and Measurement (*Top 5*)	Online
Oct. 2021	First-class Academic Scholarship in HUST (*Twice*) (*Top 10% across major undergraduate students*)	Wuhan, China
Dec. 2019	Third Prize at the 16th China Post-Graduate Mathematical Contest in Modeling	Beijing, China
Jun. 2019	2019 Outstanding Graduation Thesis of Northeastern University (*Top 3% across all Graduation Theses*)	Shenyang, China
Jun. 2019	Award of Excellence at the 3rd FixedStar Cup Graduation Project Competition of Excellent Engineers	Beijing, China
Apr. 2019	Fangda Steel Education Foundation “Fangda” Scholarship (*Only 1 across major undergraduate students*)	Shenyang, China
Jan. 2019	The Liaoning Province Outstanding Graduate Student Award (*Top 0.1% across Liaoning Province*)	Liaoning, China
Dec. 2018	Excellent project at Liaoning Province 5th Annual Conference on Innovation and Entrepreneurship	Liaoning, China
Dec. 2018	Winner of the 4th Principal’s Medal (*the highest bestowed upon students in NEU*) (*10 people across all students*)	Shenyang, China
Dec. 2018	The Shenyang City Outstanding College Student Award (*Top 0.1% across Shenyang City*)	Shenyang, China
Oct. 2018	First-class Outstanding Student Scholarship in NEU (*Top 3% across major undergraduate students*)	Shenyang, China
Jul. 2018	Award of Excellence at the National Innovative Training Program of College Students (*Top 5%*)	Shenyang, China
Jul. 2018	First prize at the 8th National College Students Mechanical Innovation Design Competition (*Top 2%*)	Hangzhou, China
Jun. 2018	Beijing SMC Education Foundation Scholarship (*Top 5% across major undergraduate students*)	Beijing, China
Nov. 2017	First Prize in Liaoning Mechanical Innovation Design Competition (*Top 5%*)	Liaoning, China

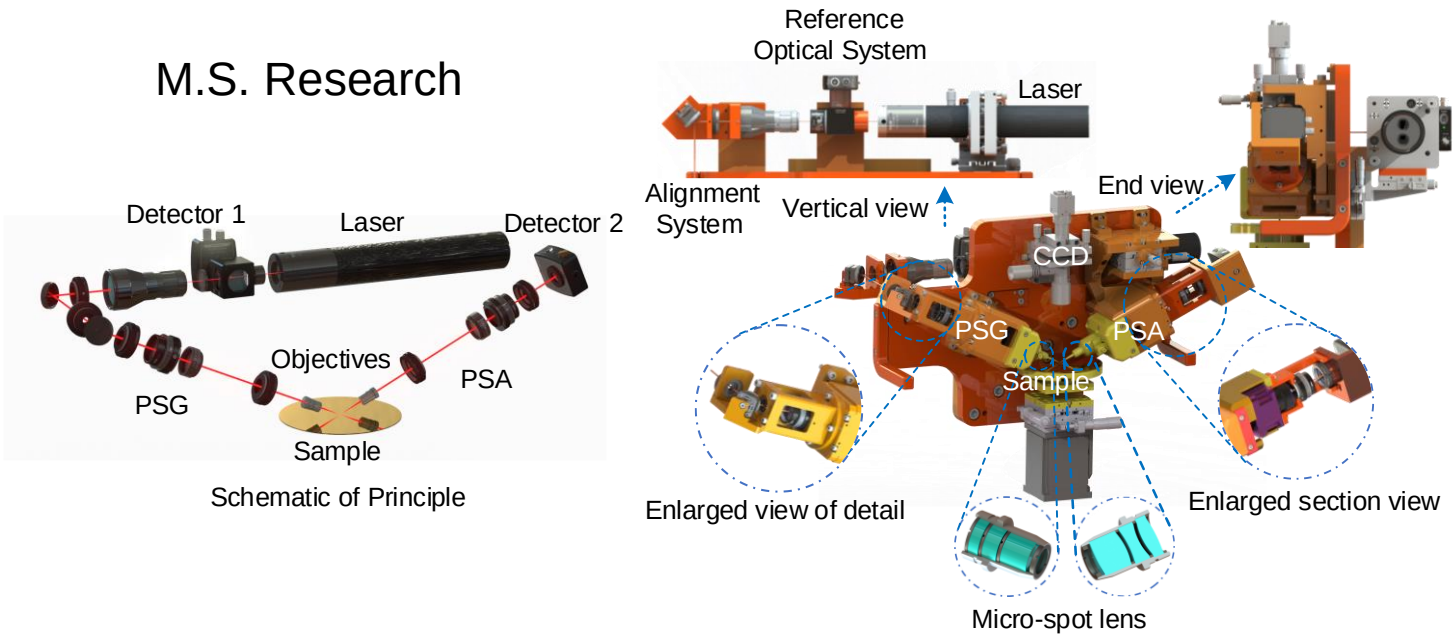

Figure I. Opto-mechanical Design Drawing

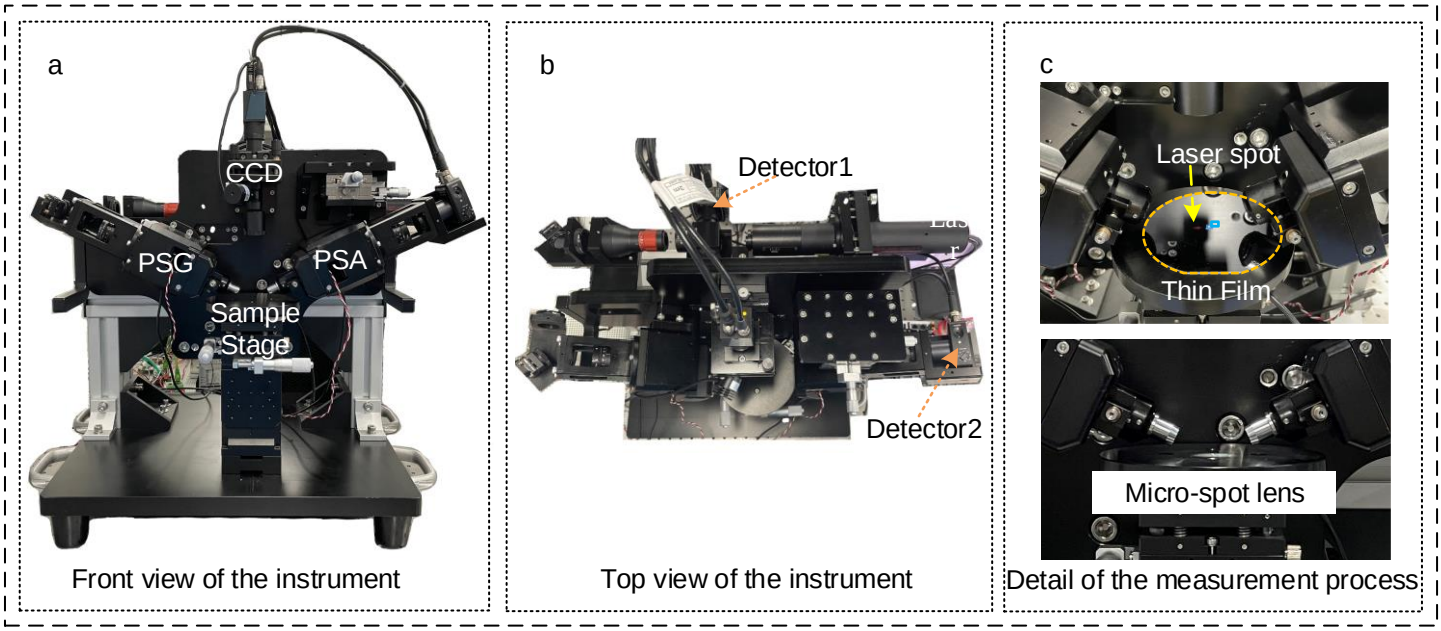

Figure II. Instrument of Single-Wavelength Ellipsometer

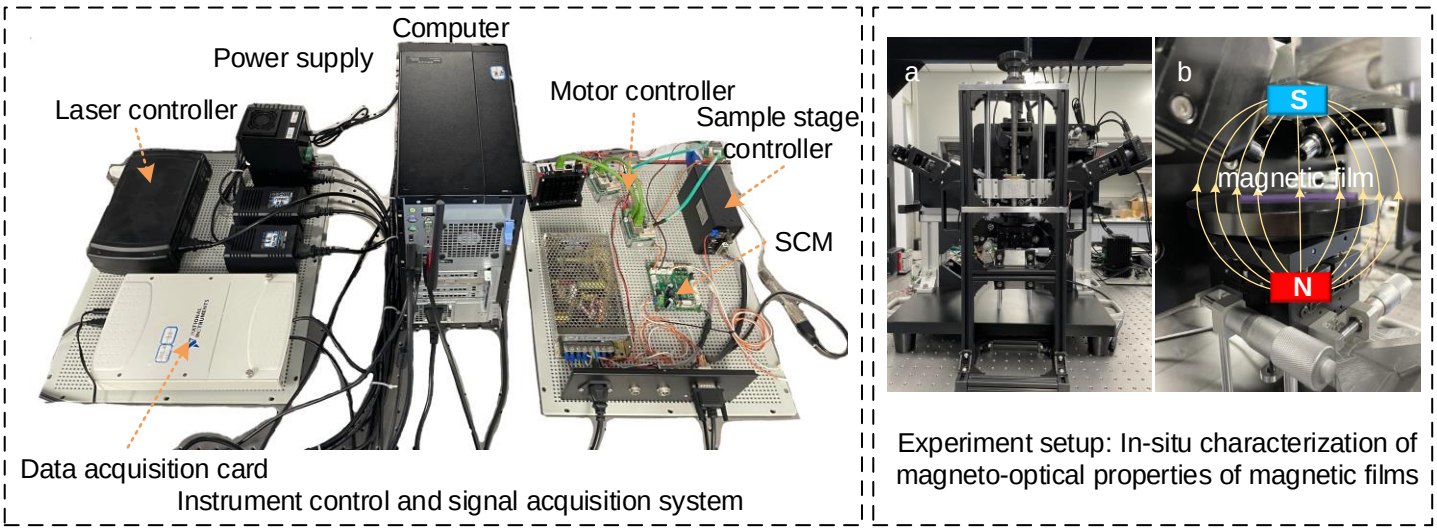

Figure III. Control System and Magneto-Optical Property Study

Presentation of Work 2 –

Development of a 5-axis Machine Tool for Additive and Subtractive Processing Based on CNC

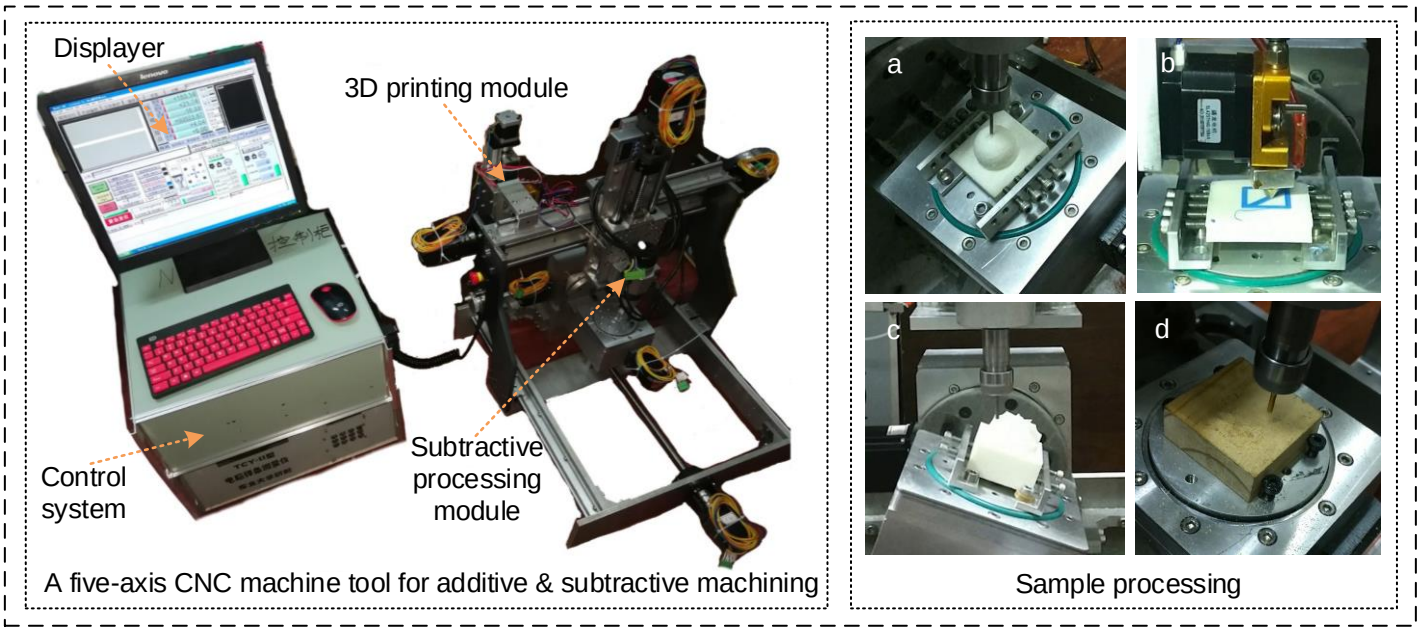

Figure I. A Small 5-Axis CNC Machine Tool for Additive and Subtractive Machining

Presentation of Work 3 –

Structure Design and Process Research of a Small Five-Axis Linkage Machine Tool Based on CNC

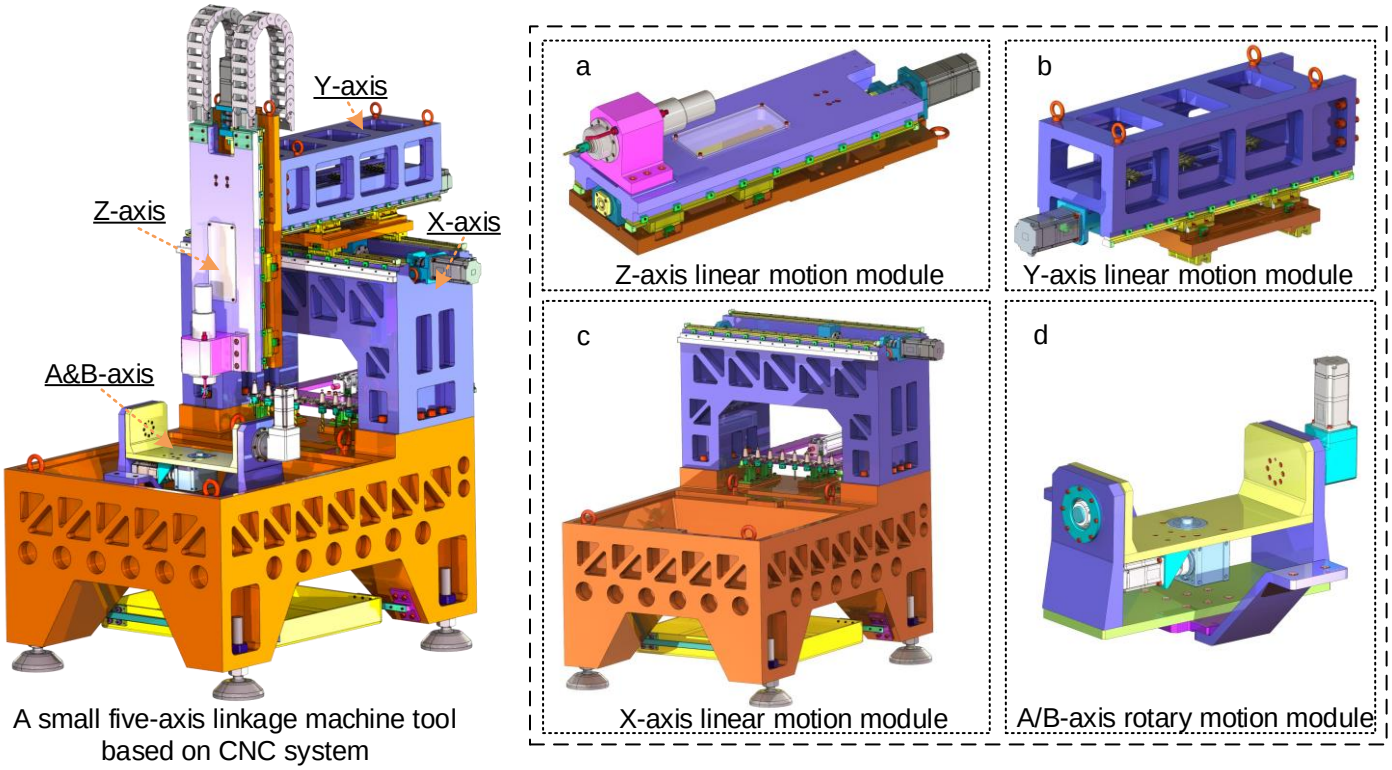

Figure I. My Undergraduate Thesis of Northeastern University

B.S. Research