National Cheng Kung University
Department of Mechanical Engineering
The Department of Mechanical Engineering at National Cheng-Kung University (NCKU) has been established since 1931, and is the oldest and the most renowned mechanical engineering institutes in Taiwan. Our alumni occupy important positions in Taiwan’s industries, business, and governmental institution. A local survey reveals that alumni from NCKU have being the most welcome employees by Taiwan business companies. A survey on academic competitiveness conducted by the Ministry of Education of Taiwan shows that, in the category of mechanical engineering, this department has the ranking of top one in Taiwan and the 39th around the world. Currently, there are 53 full time professors, 8 adjunct professors, 720 undergraduates, 360 master students, and 150 Ph.D. students in the ME department.

The undergraduate curriculum is designed to provide the students with a solid foundation in engineering science as applied to mechanical engineering, and to prepare graduates for entering graduate school and/or industry. The teaching programs are organized according to both disciplinary and inter-disciplinary themes. We cover all of the core disciplines of mechanical engineering, and the education program emphasizes on the fundamental scientific theories, technical innovation, and practical training.

The graduate programs in this department offers advanced courses and research training for qualified students leading to the degrees of the Master of Science and Ph.D. in mechanical engineering. In order to focus on profundity of research disciplinary and satisfy the need of society and industries, the faculties and their researches are divided into five divisions: (1) Thermal and Fluid Sciences, (2) Solid Mechanics, (3) Mechanical Design, (4) Manufacturing and Materials, and (5) System and Control. Details can be found in this brochure.

For the next ten years, this department is ready to face the new challenge of internationalization and globalization. It is our goal to become one of the top ranking and most influential institutes around the world. We are very happy to open our arms to all international students who are interested in pursuing advanced studies and higher education in mechanical engineering in Taiwan. We cordially invite you to join us and become part of this big family of Mechanical Engineering in NCKU.

Yu-Lung Lo, Professor and Head of the Department
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National Cheng-Kung University (NCKU)

Since its establishment in 1931, NCKU has been one of the most prestigious universities in Tainan, Taiwan, with a high reputation in science, engineering, medicine, management, planning and design. According to Times Higher Education- QS World University Rankings and Performance Ranking of Scientific Papers for World Universities, NCKU was ranked second among all universities in Taiwan. Many surveys throughout the years have shown that NCKU students are most desired by Taiwanese companies. With more than 10,000 undergraduate and 9,800 graduate students, as well as 1,400 faculty members, NCKU has 9 colleges, 40 departments, 82 graduate institutes, and 54 research centers, and it is also a major university, educational, and area-network center in Taiwan.

Since the inception of Taiwan’s Ministry of Education’s (MOE) project “Promoting Academic Excellence and Developing World Class Research Centers” in 2005, NCKU and National Taiwan University (NTU) have been chosen as the top two main schools for “promoting top-tier universities”. In 2011, the Ministry of Education has once again recognized NCKU as one of the best universities in Taiwan.

The NCKU has a profitable partnership with near 150 universities and other educational institutions worldwide. It offers a great number of students exchange programs and takes part in national, as well as international research activities.
NCKU in Facts

- Offers 41 undergraduate programs, 74 master's degree programs, 53 doctoral programs and 17 master's degree programs for working professionals.
- The first university in Taiwan to establish International Dual-degree Programs.
- Dr. Samuel Chao Chung Ting, an outstanding NCKU alumnus from the Department of Mechanical Engineering, received the Nobel Prize in Physics in 1976.
- NCKU’s satellite research group is the only university with school flat in the space with the Formosat-2 satellite.
- No.1 in Academia-Industry Collaboration Nationwide.
- NCKU graduates have been ranked as “the most industry favorites” each year since 1993.
- No.1 in Engineering and Materials Science Research Papers Ranking.
- Ranked the 80th in 2011 Webometrics Ranking of World Universities published by Centre for Scientific Information and Documentation.
Tainan, about the City

Tainan is a city located in southern Taiwan with 1.8 million populations (fifth largest city in Taiwan). It is 250 km south of Taipei and it takes 100 minutes by high speed railroad. The city is characterized by year-round relatively high temperatures (33°C in July and 17°C in January), with a rainy season (April to September) and a dry season (October to March).

Tainan was initially established by the Dutch East India Company as a ruling and trading base in 1624. After Dutch colonists were defeated by Koxinga in 1661, Tainan was remained as the capital of the Tungning Kingdom until 1683 and afterwards the capital of Taiwan prefecture under China until 1887. Tainan has been historically regarded as the culture center of Taiwan for its rich folk cultures including the famous local snack food, extensively preserved Taoist rites and other living local traditions, as well as a major ecotourism center in Taiwan. In comparison with capital area around Taipei, the living expense is much cheaper.

Once relied on agricultural and traditional manufacturing industry, this city now becomes a major center for optoelectronics, integrated circuits, green energy, and biotechnology in Taiwan with a complete supply chain. The economy development also provides excellent job opportunities for NCKU students.
Department of Mechanical Engineering

Introduction

The Department of Mechanical Engineering at National Cheng-Kung University (NCKU) has been established since 1931, and is the oldest and the most renowned mechanical engineering institutes in Taiwan. Our alumni and alumnus occupy important positions in Taiwan's industries, business, and governmental institution. In addition, numerous faculty members of Taiwan and world's leading universities are also graduated from this department. A local survey reveals that alumni from NCKU have been the most welcome employees by Taiwan business companies. Each year, 150 undergraduate students, 171 master students (including 20 part-time students), and 60 Ph.D. students are enrolled in this department each year. Currently, this department is consisted of 53 full time professors, 10 adjunct professors, 600 undergraduates, 300 master students, and 150 Ph.D. students, as well as 20 international graduate students.

Our department has excellent faculty members with extraordinary academic reputation and they are all eagerly devoted to education, and research. In together with the state of arts facilities and the innovative teaching styles, students are expected to have the most exceptional educational training leading to their successful career development. Our department offers both stringent training in fundamental knowledge of mechanical science and board introduction on the state-of-the-art engineering applications. Students who graduate from our department are not only active in mechanical related industry, but also play critical roles in other high-tech fields such as semiconductors and optoelectronics.

Offered Programs of Study

Bachelor of Science (B.S.) in Mechanical Engineering  
Master of Science (M.S.) in Mechanical Engineering  
Doctor of Philosophy (Ph.D.) in Mechanical Engineering

Organization

The teaching and research programs in this department are organized according to both disciplinary and inter-disciplinary themes and cover all of the core disciplines of mechanical engineering into five major divisions: thermo-fluid sciences, solid mechanics, mechanical design, materials and manufacturing, and system control. The education program emphasizes on the fundamental scientific theories, technical innovation, and practical training. The research program is focused on both fundamental mechanical sciences and engineering and inter-disciplinary topics to satisfy the needs from industries and societies. The department offers over 100 undergraduate and graduate courses each year. Among them, there are about 10 courses are taught in English and this number increase continuously.
ME in Facts

- One of the four oldest departments of NCKU – founded in 1931
- Oldest and largest mechanical engineering department in Taiwan.
- Ranked 39th in performance ranking of scientific papers for world universities (Mechanical engineering)
- Ranked 1st in performance ranking of scientific paper for Taiwan universities (Mechanical engineering)
- Over a quarter billion dollars (NT$) research budget with more than 300 projects in past 3 years
- Alumni occupy more than 1/3 faculty members of Taiwan's mechanical engineering departments and dominate mechanical engineering related industries in Taiwan
Undergraduate Studies

Bachelor of Science (B.S.) in Mechanical Engineering

The undergraduate program curriculum is designed to provide students with a solid foundation in engineering science as applied to mechanical engineering for their individual career paths and fosters the ability to adapt to the rapidly changing technologies faced by today’s engineers. The study period is normally 4 years and students need to complete a minimum of 145 courses credits to earn the B.S. degree. In addition, students must also satisfy the university-wide requirement in English for graduation.

Course:

Freshmen

Required Courses:

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<td>Applied Mechanics (I)</td>
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<td>Applied Mechanics (II)</td>
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<tr>
<td>General Chemistry</td>
<td>3</td>
<td>Introduction to Computers</td>
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<td>General Physics Laboratory (I)</td>
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<td>Engineering Graphics (I)</td>
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Sophomore

Required Courses:

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<td>Engineering Mathematics (I)</td>
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<td>Engineering Mathematics (II)</td>
<td>3</td>
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<td>Thermodynamics (I)</td>
<td>2</td>
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<td>3</td>
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<tr>
<td>Mechanism (I)</td>
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<td>Mechanism (II)</td>
<td>2</td>
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<tr>
<td>Mechanics of Materials (I)</td>
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<td>Material for Mechanical Engineering</td>
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<td>Mechanical Engineering Drawing</td>
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<td>Manufacturing Processes</td>
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<td>Electrical Engineering</td>
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<td>Experiments in Mechanical Engineering</td>
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<td>Machine Shop Practice (I)</td>
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Elected Courses:

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<td>Computer Program Design</td>
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<td>Mechanics of Materials (II)</td>
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### Junior

#### Required Courses:

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<td>Fluid Mechanics</td>
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<td>Automatic Control</td>
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<td>Experiments in Mechanical Engineering (II)</td>
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<td>Machine Design (II)</td>
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<tr>
<td>Electronics</td>
<td>3</td>
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<tr>
<td>Heat Transfer</td>
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<td>Experiments in Mechanical Engineering (III)</td>
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#### Elected Courses:

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<td>Introduction to Quantum Mechanics</td>
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<td>Numerical Analysis</td>
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<td>Ferrous Materials</td>
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<tr>
<td>Powder Metallurgy</td>
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<tr>
<td>Engineering Hydraulic &amp; Pneumatic Control</td>
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<tr>
<td>Tool Design</td>
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<tr>
<td>Introduction to Components of Control Systems</td>
<td>3</td>
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<tr>
<td>Advanced Engineering Mathematics</td>
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<td>Computer Graphics</td>
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<td>Stress Analysis</td>
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<tr>
<td>Mechanical Vibration</td>
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<td>Basic Finite Element Method</td>
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<td>An Introduction to Energy Science and Technology</td>
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<tr>
<td>Servo Control</td>
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<td>Practical Training</td>
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### Senior

#### Elected Courses:

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<td>Precision Process &amp; Measurement</td>
<td>3</td>
</tr>
<tr>
<td>Experimental Design</td>
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<tr>
<td>Fundamentals of Optics</td>
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<table>
<thead>
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<tr>
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<tr>
<td>Computer-Aided Mechanical Design</td>
<td>3</td>
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<tr>
<td>Introduction to Machine Tool</td>
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<tr>
<td>Principle of Automobile</td>
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<td>Thesis (II)</td>
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Graduate Studies

Master of Science (M.S.) in Mechanical Engineering
The MS degree typically takes 2 years to complete. Students must earn at least 24 course credits and finish and defense of a master thesis based on his/her original research. Each student should choose one or two academic advisor(s) for supervising his/her course study and academic research.

Doctor of Philosophy (Ph.D.) in Mechanical Engineering
The Ph.D. degree typically takes 3-5 years to complete. Courses are the focus of the early part of the PhD degree in order to enhance ones knowledge to conduct research. Within two year of entering the program a student must take the departmental Ph.D. qualifying examination in three subject areas in Mechanical Engineering. In addition, to receive his/her Ph.D. degree, a student must also complete at least 18 course credits, a dissertation based on his/her original research, and papers accepted by international journals. Each student should choose one or two academic advisor(s) for supervising his/her course study and academic research. In addition, a dissertation committee (by 3-4 professors) should be organized for guiding the Ph.D. thesis work.
Facts for International Students

Application:
NCKU ME welcomes applications from qualified individuals all over the world for both undergraduate and graduate studies. The application deadlines are approximately April 10 (for Fall semester) and October 20 (for coming Spring semester) each year. The office of International Affairs (OIA) of NCKU takes fully charge of the administration issue. Please visit http://admissions.oia.ncku.edu.tw for detail application procedures, required documents, admission details, and other contacts.

Scholarship:

Graduate students: For accepted master and Ph.D. students, NCKU offers free dormitory and waives their tuitions and provide a monthly salary for two years (MS) and three years (Ph.D.). The exact amount varies each year. Nevertheless, the scholarship (salary, free tuition, and free dormitory) should be able to cover most of the living expense in Tainan city. Please visit http://admissions.oia.ncku.edu.tw/ for detail.

Useful Information:
For information about visa, medical insurance, Chinese language training, driving license application, as well as other student activities and other FAQs, please visit http://oia-en.ncku.edu.tw/files/11-1040-5172.php for detail.
Thermo-Fluid Science Division
<table>
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<tr>
<th>Position</th>
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<th>Education Background</th>
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<tr>
<td>Chair Professor</td>
<td>Jen-Fin Lin</td>
<td>Ph.D., Mechanical Engineering, Columbia University, USA</td>
<td>Micro/Nano Tribology, Nano Measurements, Inspection and Fabrication, Chemical Mechanical Polishing, Multiscale Mechanics.</td>
<td>Micro/Nano Tribology Lab.</td>
<td><a href="mailto:jflin@mail.ncku.edu.tw">jflin@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Distinguished Professor</td>
<td>Ching-Jenq Ho</td>
<td>Ph.D., Mechanical Engineering, Purdue University, USA</td>
<td>Latent Heat Energy Storage, Buoyancy-Driven Flow, Material Processing Heat Transfer, Heat Transfer Efficacy of Functional Fluids</td>
<td>Lab. of Professor C. J. Ho</td>
<td><a href="mailto:cjho@mail.ncku.edu.tw">cjho@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Distinguished Professor</td>
<td>Jin-Yuh Jang</td>
<td>Ph.D., Mechanical Engineering, State University of New York at Buffalo, USA</td>
<td>Heat Exchangers, Design, Air-conditioning and Refrigeration, Computational Fluid Dynamics, Hydrodynamic Stability.</td>
<td>Heat Exchangers Research Lab.</td>
<td><a href="mailto:ling@mail.ncku.edu.tw">ling@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Distinguished Professor</td>
<td>Ta-Hui Lin</td>
<td>Ph.D., Mechanical Engineering, Northwestern University, USA</td>
<td>Combustion Science and Technology, Energy Utilization, Air Pollution Control and Fire Research.</td>
<td>Combustion Science and Technology Lab.</td>
<td><a href="mailto:thlin@mail.ncku.edu.tw">thlin@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Distinguished Professor</td>
<td>Han-Taw Chen</td>
<td>Ph.D., Mechanical Engineering, National Cheng Kung University, Taiwan</td>
<td>Heat Exchanger, Bio-Heat Transfer, Cooling of Electronic Equipments, Design and Test of Green Materials.</td>
<td>Inverse Problem Lab.</td>
<td><a href="mailto:cheoh@mail.ncku.edu.tw">cheoh@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Professor Chih-Yang Wu</td>
<td></td>
<td>Ph.D., Mechanical Engineering, University of Oklahoma, USA</td>
<td>Heat Transfer, Fluid Dynamics.</td>
<td>Lab. of Professor C. Y. Wu</td>
<td><a href="mailto:cwy@mail.ncku.edu.tw">cwy@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Professor Yue-Tzu Yang</td>
<td></td>
<td>Ph.D., Mechanical Engineering, University of Liverpool, UK</td>
<td>Electronics Cooling, Numerical Conjugate Heat Transfer, Numerical Computations of Turbulent Flow, CFD and Combined Optimization.</td>
<td>Computational Thermal Fluid Lab.</td>
<td><a href="mailto:styang@mail.ncku.edu.tw">styang@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Professor Chen-I Hung</td>
<td></td>
<td>Ph.D., Mechanical Engineering, National Cheng Kung University, Taiwan</td>
<td>Fluid Machinery, Thermal Energy System, Microfluidics, Cooling Technology.</td>
<td>Manufacturing Thermalfluid Lab.</td>
<td><a href="mailto:chihung@mail.ncku.edu.tw">chihung@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Professor Sheng-Yue Hwang</td>
<td></td>
<td>Ph.D., Mechanical Engineering, University of Illinois at Urbana-Champaign, USA</td>
<td>Polymer Processing, Composite Processing, CAD/CAM, IC Packaging.</td>
<td>Polymer Processing Lab.</td>
<td><a href="mailto:jshuyu@mail.ncku.edu.tw">jshuyu@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Professor Tian-Shiang Yang</td>
<td></td>
<td>Ph.D., Mechanical Engineering, Massachusetts Institute of Technology, USA</td>
<td>Thermo-fluid Sciences, Wave Dynamics, Modeling and Analysis of Semiconductor Manufacturing Process.</td>
<td>Wave and Vibration Dynamics Research Lab.</td>
<td><a href="mailto:tsyang@mail.ncku.edu.tw">tsyang@mail.ncku.edu.tw</a></td>
</tr>
</tbody>
</table>
Graduate courses:

- Introduction to Fluid Mechanics
- Conduction Heat Transfer
- Introduction to Heat & Mass Transfer
- Gas Kinetic Theory
- Radiative Heat Transfer
- Fracture Mechanics
- Micro/Nano Tribology Issues
- Advanced Theory of Combustion
- Numerical Heat Transfer
- Computational Fluid Dynamics
- Transport Phenomena in Manufacturing Processes
- Introduction to Nonlinear Dynamical Systems and Chaos
- Theory and Application of Polymer Rheology
- Viscous Fluid Mechanics
- Engineering Two-Phase Flows
- Polymer Processing
- Advanced Thermodynamics
- Micro/Nanoscale Heat Transfer
- Polymer Rheology
- Convection Heat Transfer
- Theory of Combustion
- Experimental Stress Analysis
- Advanced Computational Fluid Dynamic

Associate Professor Yi-Chun Wang Ph.D., Mechanical Engineering, California Institute of Technology, USA
Fluid Mechanics, Engineering Two-Phase Flows, Ultrasonic Cavitation, LTCC Tape Technology, Absorption-Refrigeration Systems. Multi-Phase Flows Lab. sungey@mail.ncku.edu.tw

Assistant Professor Gien-Huang Wu Ph.D., Engineering Mechanics, University of Wisconsin-Madison, USA
Polymer Fluid Flow, IC Packaging. Mold Design Lab. dhuangy@mail.ncku.edu.tw

Associate Professor Chang-Da Wen Ph.D., Mechanical Engineering, Purdue University, USA
Radiation Thermometry, Electronic Cooling, Two-Phase Flow and Heat Transfer. Wen's Heat Transfer Lab. adwen@mail.ncku.edu.tw

Associate Professor Yu-Bin Chen Ph.D., Mechanical Engineering, Georgia Institute of Technology, USA
Thermal Radiation, Optoelectronics, Energy Conversion and Utilization, Optics and Photonics, Micro/Nanoscale Fabrication. Nanoscale Engineering Radiation Lab. ycheny@mail.ncku.edu.tw

Assistant Professor Ming-Hsun Wu Ph.D., Mechanical Engineering, Pennsylvania State University, USA
Detonation, Oxycombustion, Micro Reacting Flow Systems. Reacting Flow Lab. mhwu@mail.ncku.edu.tw
Research Labs

◆ Micro/Nano Tribology Lab
  ● Tribology of ceramic materials.
  ● Analyses in high-speed ball bearings and ball screws.
  ● Microcontact mechanics for rough surfaces and single/multi fractal theory for the treatment of various random signals.
  ● Tribological analyses of the chemical mechanical polish in wafers.
  ● Nanoindentation technologies and theoretical models developed for the mechanical properties and mechanics of defect/fracture of various coating films and lump materials.
  ● Multiscale mechanics and coarse-grain molecular dynamics developed for the defects and phase changes in crystal materials arising at various stresses.
  ● Metal-induced crystallizations of silicon and the applications for a-Si solar cell.
  ● Design for the tester of thin film electrical resistivity and thermal diffusivity.

◆ Lab. of Professor C. J. Ho
  ● Heat transfer during melting and solidification of materials
  ● Latent heat thermal energy storage
  ● Buoyancy-driven convection flow and heat transfer
  ● Heat transfer related to material processing
  ● Thermal management, and
  ● Heat transfer efficacy of functional fluids (nanofluids, PCM suspensions and so on).

◆ Heat Exchangers Research Lab
  ● Thermal design and analysis for heat exchanger.
  ● Enhancement of heat transfer in porous media.
  ● Utilization and conversion of thermal energy.
  ● Optimization of proton exchange membrane fuel cell and steam reformer channel design.
  ● Cooling efficiency of jet cooling system for hot strip mill.
  ● Optimal design of thermoelectric generator module used in waste heat recovery system.
◆ Combustion Science and Technology Lab

Basic researches on compound drops combustion, spray combustion, flame interaction, flame stabilization, and flame synthesis of carbon nano-materials; Burning by-product combustible gases, fuel oil, emulsified fuel and biofuel used in industrial furnaces and boilers; Oxy-coal combustion for CO2 capture in industrial furnaces; Full-scale fire researches; Developments on offshore wind power in Taiwan.

◆ Inverse Problem Lab

The main study of the Inverse Problem Laboratory is to apply the hybrid inverse method to investigate various inverse problems (IHCP). This hybrid inverse method involving the Laplace transform method or finite difference method in conjunction with the least-squares method and experimental data within the test material is self-created. It can successfully be applied to estimate the unknown physical quantities for heat sinks, heat exchangers bio-heat transfer and spray cooling heat transfer, etc. In addition, this laboratory is also engaged in testing and design of various saving-energy glasses. Our estimated results have good accuracy and reliability.

◆ Lab. of Professor C. Y. Wu

Modeling, simulation and experiment of radiative transfer, especially those in scattering or refractive media. Design, fabrication, modeling, simulation and experiment of micromixer and optofluidic lens with applications for MEMS devices.

◆ Computational Thermal Fluid Lab

- Electronic cooling
- Numerical computations of turbulent flow
- Numerical simulations of nanofluids
- Thermal analysis of porous media
- Numerical computations of micro-channel heat sink
- Numerical simulations of a portable electric device using phase change materials Optimization
Manufacturing Thermalfluid Lab

Our laboratory recently focus on the energy and environment engineering, and the research topics are given as:

1. Hydrogen production and hydrogen separation
2. Bioenergy
3. Clean coal technology
4. CO₂ capture and reduction
5. Thermoelectric system

Polymer Processing Lab

- Design and analysis of BIPV modules
- Development and application of induction heating for injection molding process
- Molding simulation and stress analysis for IC encapsulation
- Study of mold adhesion phenomenon during IC encapsulation and injection molding process
- Development of solar cell via electrical plating process
- Development of injection molding machine
- Development and analysis of biomedical devices

Wave and Vibration Dynamics Research Lab

The research activities in the Wave and Vibration Dynamics Research Group of Prof. T.-S. Yang primarily are mathematical modeling and theoretical analysis of physical and engineering problems that are of fundamental and/or technological interest. However, some experiments also are carried out in the group so as to validate the theoretical research findings. Some recent research projects include (1) the nonlinear impact dynamics of valveless pumping systems, (2) the contact mechanics and slurry flow dynamics in the semiconductor manufacturing process of chemical-mechanical planarization (CMP), (3) the thermofluid analysis of metal-hydride hydrogen storage systems, and (4) the optical and thermal analysis of high-concentration photovoltaic (HCPV) modules.
◆ **Multi-Phase Flows Lab**

Areas of research interest include theoretical and experimental studies on ultrasonic cavitation peening technique; liquid film dynamics and performance enhancement of aqueous lithium bromide absorbers; acoustic cavitation and sonochemistry; low temperature co-fired ceramics (LTCC) tape technology and applications; gas/liquid two-phase flows; flow dynamics in micro-fluidic devices.

◆ **Mold Design Lab**

- The Polymeric Fluid Flow.
- Thermal Study of Electronic Assembly.
- Investigation of Thermo-Mechanical Fatigue Reliability of Electronic Assembly.

◆ **Wen’s Heat Transfer Lab**

Applications in radiation thermometry for metal industry. Assessment of MRT(multispectral radiation thermometry) and ANN(artificial neuron networks) method. Experimental investigation of metal emissivity characteristics. Experimental and numerical studies on multistage thermoelectric cooler with varied deployment. Analysis of heat transfer characteristics of microchannel heat sink using nanofluids. Radiation safety performance of fire doors and fire windows.

◆ **Nanoscale Engineering Radiation Lab**

Thermal Radiation, Optoelectronics, Energy Conversion and Utilization, Optics and Photonics, Micro/Nanofabrication

◆ **Reacting Flow Lab**

Deflagration-to-detonation transition (DDT), Oxy-combustion, Micropropulsion systems, Engine simulation, Combustion safety
Solid Mechanics Division
<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Education Background</th>
<th>Research Area</th>
<th>Lab name</th>
<th>E-mail</th>
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</thead>
<tbody>
<tr>
<td>Chair Professor</td>
<td>Lien-Wen Chen</td>
<td>Ph.D., Mechanical Engineering, Rensselaer Polytechnic Institute, USA</td>
<td>Plates &amp; Shells, Mechanics of Composite Materials, Structure Dynamics.</td>
<td>Metamaterial Lab.</td>
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<tr>
<td>Distinguished Professor</td>
<td>Sen-Yung Lee</td>
<td>Ph.D., Engineering Science, State University of New York at Buffalo, USA</td>
<td>Vibration and Wave Propagation, Solid Mechanics, Creative Engineering, Nonlinear Analysis.</td>
<td>Mechanics and System Engineering Lab.</td>
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</tr>
<tr>
<td>Distinguished Professor</td>
<td>Hsin-Yi Lai</td>
<td>Ph.D., Mechanical Engineering, University of Wisconsin-Madison, USA</td>
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<td>System Engineering Lab.</td>
<td><a href="mailto:hylai@mail.ncku.edu.tw">hylai@mail.ncku.edu.tw</a></td>
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<td>Distinguished Professor</td>
<td>Yu-Lung Lo</td>
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<td>Optical Fiber Sensors, Optical Precision Measurements, Micro-Opto-Electro-Mechanical System, Liquid Crystal Cell Tests.</td>
<td>Micro Opto-Electronics Sensor Lab.</td>
<td><a href="mailto:lyl@mail.ncku.edu.tw">lyl@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Professor</td>
<td>Tei-Chen Chen</td>
<td>Ph.D., Mechanical Engineering, National Cheng Kung University, Taiwan</td>
<td>Theory of Elasticity, Theory of Plasticity, Thermal Stresses, Measurement Science, Micro-and Nano-Scale Mechanics.</td>
<td>Thermal Stress Lab.</td>
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<td>Professor</td>
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<td>Ph.D., Applied Mechanics, Lehigh University, USA</td>
<td>Fracture Mechanics, Theory of Elasticity, Strength of Materials.</td>
<td>Fracture Mechanics Lab.</td>
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<td>Professor</td>
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<td>Digital Photomechanics, Experimental Stress Analysis, Micro-Materials/Structural Testing/Measurement</td>
<td>Photomechanics Lab.</td>
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<tr>
<td>Professor, Head of</td>
<td>Yung-Chain Lee</td>
<td>Ph.D., Applied Mechanics, Northwestern University, USA</td>
<td>Elastic Wave Propagation, Plasmaelectrics, Excimer Laser Micromachining, Nano-Imprinting &amp; Roller Imprinting</td>
<td>Nano/Micro-Structure and Applied Physics Lab.</td>
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<tr>
<td>department</td>
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<tr>
<td>Professor</td>
<td>Kuo-Shen Chen</td>
<td>Ph.D., Mechanical Engineering, Massachusetts Institute of Technology, USA</td>
<td>MEMS, Mechanical Properties of Materials, Solid Mechanics, Mechatronics, Precision Engineering.</td>
<td>System Dynamics Lab. For Mechatronics and Microsystems</td>
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</tr>
</tbody>
</table>
Graduate courses:

- Viscoelasticity
- Theory of Elasticity
- Mechanics of Vibration
- Analytical Dynamics
- Nonlinear Vibrations
- Experimental Design
- Precision Measurements by Optical Methods
- Introduction on Simulation Methods of Micro-Systems

Research Labs

- **Metamaterial Lab**

  Our group focuses on the design of novel optical and acoustic device based on the following topics:

  1. Phontonic crystals: We are mainly working on the design and application of optical device using photonic crystals such as optical waveguides, cavities, tunable optical components, superlens, and so on.
  2. Sonic crystals: In analogy to photonic crystals, we focus on the propagation of acoustic wave in sonic crystals and verified the results by experiments.
3. Optical/acoustic transformation: Based on transformation of coordinates, we design and simulate a variety of optical/acoustic devices by the use of metamaterials.

- **Mechanics and System Engineering Lab**

  Nonlinear static and dynamic analysis, vibration analysis of non-uniform beams, vibration analysis of atomic force microscopy probe, hunting stability analysis of railway vehicle truck system, design and analysis of super-hydrophobicity structure, centrifugal fan applied on computers, simulation of a piezoelectric micro-pump.

- **System Engineering Lab**

  This laboratory proposes an two-stage experimental design method and the associated standard procedure to allow the characterization of physiological and pathological diagnosis for human bodies. In the past, the established models of diseases and symptoms considered only the main effect of significant factors themselves, and ignored the interactive effects among significant factors. By so doing, it often leads to the construction of biased and erroneous models. Since the organic system is highly nonlinearly coupled, and, therefore, the interactive terms are often very significant. This laboratory is thus devoted to construct sets of rigorous experimental and practical design rules for possible modeling and applications in organism's physiological and pathological study.

- **Micro Opto-Electric Mechanical Sensors Lab**

  Experimental mechanics, Optical techniques in precision measurements, Ellipsometry in thin film analysis, Biophotonics for medial diagnosis, Near-field optics, Measurements in optical properties of liquid crystal and semiconductor, Highly sensitive gas sensors based on core-shell nanoparticles, Mueller matrix and Stokes vector analysis, Fiber optic sensors.

- **Thermal Stress Lab**

  The scope of study in this lab includes thermal stress and residual stress analysis in welding and heat treatment processes; optical properties of thin film structures influenced by thermal and mechanical loadings; mechanical and electrical properties of nano structures such as nanowires, carbon nanotubes and thin films; phase transformation of Si-crystalline materials induced by mechanical loadings. A variety of methods including theoretical approaches, finite element method, molecular dynamics method, and density functional theory are
generally adopted to investigate and solve the problems above mentioned.

**Fracture Mechanics Lab**

The present research fields of Fracture Mechanics Laboratory include the stress singularities of wedge and junction problems, fracture problems of Functionally Graded Materials (FGMs) under thermal loads, vibration of violins, and reconstructed operation analysis on mandibular defects. In the violin analysis, we emphasis on the roles of bridge, sound-post, and bass bar played in the evaluation of violin quality. All results are obtained by employing the finite element method and/or the mathematical tools, such as the integral transform method, singular integral equation.

**Photomechanics Lab**

Optical measurement has the advantage of non-contact, full-field, high speed and high precision, and is wildly used in engineering. Our research interests are the developments and applications of optical measurement methods for (1) surface profile measurement by shadow moiré, fringe projection, or white light interferometry; (2) deformation measurement by digital image correlation, instantaneous phase-shifting electronic speckle pattern interferometry (ESPI) and shearography; (3) stress analysis by digital photoelasticity; (3) internal defects inspection by infrared thermography; and (4) dimensions and shape measurement by digital image processing techniques.

**Nano/Micro-Structure and Applied Physics Lab**

Our group has been focusing on the following research topics in recent years:

- Ultrasound Engineering and Non-destructive Evaluation
- Acoustic Microscopy and Ultrasound Imaging Scanning
- Wave Propagation in Solids
- Piezoelectric Materials and Surface Acoustic Wave (SAW) Devices
- Excimer Laser Micromachining System for 3D Micro-fabrication Aspheric Microlens Array and Beam-Pen Photolithography
- Nano-Imprinting for Large-Area Nano-fabrication
- Seamless Roller Mold and Roll-to-Roll Continuous Roller Imprinting
- Optical Films for Flat Panel Display Backlight
- Sub-micrometer Patterned Sapphire Substrate (PSS) for High Brightness LEDs
System Dynamics Lab. For Mechatronics and Microsystems

Present research topics including: Modeling and simulation of MEMS devices, mechanics and characterization for thin films and soft materials, Reliability and failure analysis of microsystems, CAD development for MEMS and IC fabrication, Modal testing and structural dynamic analysis, Design and control for precision motion systems, mobile robots for intelligent life applications.

Computational Mechanics Lab

Introduction to the computational mechanics LAB:
Primary research area of the computational mechanics LAB are solid mechanics, finite element method and parallel computations. We use multi-kernel CPU, multi-computer and the hundreds of computational units in the graphics processors in parallel computations. B-spline finite element method, higher order finite element method and graphics user interface design are the research topics related to the finite element method. The commercial finite element code ANSYS and COSMOS are used in the finite element analysis of some real industrial problems. The image of a motorcycle frame and the finite element modal analysis results are shown in the pictures.

Nano-Computation Lab

Our research is mainly about the properties (e.g., mechanical, electronic, thermal and piezoelectric) of nanomaterials/nanostructures including nanofilms, nanowires, carbon nanotubes and their composites. In our lab, there are two major approaches to achieve the goal.

1. Theoretical model
   Since the mechanical properties of nanomaterials depend on their characteristic length, traditional continuum theory cannot explain the material behavior at nanoscale. We have proposed a semi-continuum model to describe the size dependent behaviors of nanowires and nanofilms.

2. Numerical simulation
   In our lab, we have the ability to perform various numerical simulations, including first principal, molecular statics, molecular dynamics and finite element, to study nanomaterials. We also developed a hierarchical multiscale simulation scheme to deal with problem involving several orders of dimensions.
Applied Solid Mechanics and Electronic Packaging Lab

The Applied Solid Mechanics and Electronic Packaging Lab's research is in the areas of mechanical characterization, physics-based modeling and reliable design for macro- and micro-scale structures in the application fields including electronic components and systems, composite materials and aerospace. In particular, the research is developing viscoelastic and viscoplastic models of electronic materials for to be included in the thermomechanical models for electronic component process and reliability optimization. The Lab’s research also aims to understand the behavior and reliability of materials interface through experimental fatigue debonding growth characterization and fracture mechanics analysis.
Mechanical Design Division
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<tr>
<th>Position</th>
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<th>Education Background</th>
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<th>Lab name</th>
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</thead>
<tbody>
<tr>
<td>Chair Professor</td>
<td>Hong-Sen Yan</td>
<td>Ph.D., Mechanical Engineering, Purdue University, USA</td>
<td>Mechanism and Machine Design, Creative Design, History of Machinery.</td>
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<td>Ming-June Tsai</td>
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<td>Professor</td>
<td>Yahau Lewis Chen</td>
<td>Ph.D., Engineering Mechanics, University of Florida, USA</td>
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<td>Professor</td>
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<td>Mechanism Design, Muscle Skeletal Models of Human Bodies, Dynamics of Machinery, Optimum Design.</td>
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<td>Professor</td>
<td>Chin-Tien Huang</td>
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<td>Kinematics/Dynamics, Mechanism Design, Theory of Gearing, Robotics.</td>
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<tr>
<td>Professor</td>
<td>Jing-Jing Fang</td>
<td>Ph.D., Mechanical Engineering, Heriot-Watt University, UK</td>
<td>Virtual Reality Applications, Object-Oriented Design, Geometric Modeling.</td>
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<td>Associate Professor</td>
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<td>Applications of Geometric Modeling, Design Automation.</td>
<td>CAD Application Lab.</td>
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<tr>
<td>Associate Professor</td>
<td>Chao-Chih Lin</td>
<td>Ph.D., Mechanical Engineering, Georgia Institute of Technology, USA</td>
<td>Compliant Mechanism, Mechatronics, Mechanical Design.</td>
<td>Mechatronics System Design Lab.</td>
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</tr>
<tr>
<td>Associate Professor</td>
<td>Kuei-Yuan Chan</td>
<td>Ph.D., Mechanical Engineering, University of Michigan at Ann Arbor, USA</td>
<td>Design Optimization, Reliability-based Design Optimization, Large-Scale System Design, Life Cycle Assessment.</td>
<td>System Optimization Lab.</td>
<td><a href="mailto:jchan@mail.ncku.edu.tw">jchan@mail.ncku.edu.tw</a></td>
</tr>
<tr>
<td>Associate Professor</td>
<td>Tsai-Jeon Huang</td>
<td>Ph.D., Mechanical Engineering, State University of New York at Buffalo, USA</td>
<td>Anthropomorphic Test Device Development, Human Body Dynamics and Kinematics, Interdisciplinary Design.</td>
<td>Advanced Bio-Safety Research &amp; Design Lab.</td>
<td><a href="mailto:tjhuang@mail.ncku.edu.tw">tjhuang@mail.ncku.edu.tw</a></td>
</tr>
</tbody>
</table>
Graduate courses:

- Mechanism Design
- Dynamics of Machinery
- Computational Kinematics
- Optimal Design
- Theory of Gearing, Reliability in Mechanical Design
- Fundamentals of Automotive Crashworthiness
- Object Oriented Programming and Its Applications
- Development and Application of Anthropomorphic Test Devices
- Machine Vision
- Taguchi Method for Quality Design
- Flexure-Based Mechatronics System
- Mechanical Design of Robotics

Research Labs

- Creative Machine & Design Education & Research Lab

  Mechanism and machine design, Conceptual design of mechanisms, Reconstruction designs of ancient machines, Servo controlled variable-speed mechanisms, Innovative design of integrated permanent-magnet rotating electric machines with gear mechanisms, Locks.

- Mechanism Design Lab

  Mechanism Design Laboratory was established by Prof. Wen-Miin Hwang in 1984. The current research topics are: (1) Kinematic Synthesis of Compound Planetary Gear Trains of Automatic Transmissions, (2) Improved Designs for Adjustable Ejector Mechanisms of Nut Formers, (3) On the Characteristics of Acceleration Poles for Planar Linkages, and (4) Defect-Free Dimensional Synthesis of Planar Linkages. The application domains include mechanism design, automation equipments, and automotive transmissions, etc. Computers are the major equipments in the Lab. There are more than two hundreds books for reading. In addition, proceedings, journals, theses, and reports are richly collected for reference.

- Robotics and Automatic Research Lab

  Robotic and automation, Machine vision, Image process and feature recognition, Geometrical reverse engineering, 3D Body scanning and motion tracking, Digital human modeling, Body motion processing, Design of various robots and 3D machine vision for Industrial applications.
Knowledge Engineering and Design Automatic Lab

Optimal Design Method and Structural Optimization, Product Design, Artificial Intelligence in Design, Innovative Design (TRIZ Method), Green Design (Eco-Design), Biomimetics Design

Lab. of Professor S. T. Chious

Human body musculoskeletal models, Balancing design of mechanisms, Cam and gear mechanism design.

Theoretical and Computational Kinematics Lab

- Kinematic and dynamic analysis of planar and spatial mechanisms
- Screw Theory and its applications in the design and analysis of spatial mechanisms
- Theory of linear kinematics that leads to the unification of finite and infinitesimal kinematics
- Theoretical and computational kinematics that focuses on the mathematical modeling of spatial mechanisms and the solutions to equations arising in mechanism analysis and design.
- Theory of gearing with an emphasis on the design of chain mechanisms, such as engine timing chain systems.

Virtual Reality & Multimedia Lab

Research in Virtual Reality and Multimedia lab. focuses developing software and hardware devices in the fields of VR applications in biomedical engineering and rehabilitation science. During long term collaboration with orthopedics, oral and maxillofacial, plastic, and dental surgeons, the biotech outcomes have successfully applied in over 300 complex clinical cases. The self-built VR environments are used to rehabilitate patients with Parkinson’s disease and children with movement disorder.

CAD Application Lab

The recent research interest is about a multidisciplinary project that employed the concept of reverse engineering to develop a computer aid engineering process (Fig. 1), which is to assist a prosthetist to fabricate a total surface bearing (TSB) transtibial socket with comfortable fit to volunteer amputees.

To overcome the drawbacks of the plaster-based manual method of fabricating PTB (patella tendon bearing) sockets that will take a long period of time to cultivate a well skilled and experienced prosthetist, this project
focus on: (1) Developing a customized computer-aided system that can be easily used by a prosthetist to design CAD socket models for the use of a rapid prototyping (RP) machine; (2) Employing simple and low cost tools such as a hand-held 3D scanner (Fig. 2), easily-used CAD system and a low cost RP machine, so that a TSB socket with good quality of fit can be easily fabricated by an unskilled prosthetist.

- **Mechatronics System Design Lab**

  Current research interests in the Mechatronics System Design Lab:
  
  Compliant mechanism design, flexure-based mechatronics systems, bio-inspired robotic mechanisms, design of air machines

- **System Optimization Lab**

  System Optimization Laboratory (SOLab) was established on 2006 by Dr. Kuei-Yuan Chan. Our overarching goal is to provide systematic and rigorous approaches for optimal, robust, and reliability design under uncertainty. Our current research activities include: Robust and Reliability in Design Optimization, Complex System Decomposition and Interaction, Multidisciplinary and Multiobjective Design Optimization, Design under Uncertainty, Policy Decision-Making under Uncertainty, Design Integration, Reliability Analysis of Static and Dynamic Systems, Uncertainty Propagation for Computer Simulations.
  
  The most current research activities and grants, among other SOLab information, can be found at http://solab.me.ncku.edu.tw/

- **Advanced Bio-Safety Research & Design Lab**

  The main interests in Advanced Bio-safety Research & Design Laboratory are to perform safety researches in automobile, playground, and workplace, etc., based on engineering knowledge and methodology with human factor concern. The recent researches include anthropomorphic test device system design and analysis, human model simulation, occupant safety and protection, pedestrian safety and protection, playground safety, automotive restraint system design, robotic safety evaluation, and injury analysis based on engineering quantity.
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</tr>
</thead>
<tbody>
<tr>
<td>Distinguished</td>
<td>Rong-Shean Lee</td>
<td>Ph.D., Mechanical Engineering, University of Leeds, UK</td>
<td>Metal Forming, Computer-Aided Manufacturing, Applied Plasticity, Precision Manufacturing.</td>
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<tr>
<td>Professor</td>
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<tr>
<td>Distinguished</td>
<td>Hwa-Teng Lee</td>
<td>Dr. -Ing., Department of Ferrous Metallurgy, RWTH Aachen University, Germany.</td>
<td>Failure Analysis, Mechanical Testing and Microanalysis, Mechanical Material.</td>
<td>Micro Analysis &amp; Failure Diagnosis Lab.</td>
<td><a href="mailto:htlee@mail.ncku.edu.tw">htlee@mail.ncku.edu.tw</a></td>
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<td>Professor</td>
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<tr>
<td>Distinguished</td>
<td>Woei-Shyan Lee</td>
<td>Ph.D., Mechanical Engineering, Ecole Centrale de Nantes, France</td>
<td>Dynamic Impact Mechanics, High Strain Rate Deformation, Impact Fracture Mechanics.</td>
<td>Impact Lab.</td>
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<td>Professor</td>
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<tr>
<td>Distinguished</td>
<td>Psang-Dain Lin</td>
<td>Ph.D., Mechanical Engineering, Northwestern University, USA</td>
<td>Error Analysis of Multi-Axis Machine, Design and Analysis of Optical Elements and Systems.</td>
<td>Geometrical Optics Lab.</td>
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<td>Professor</td>
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<td></td>
<td>Su</td>
<td>Ph.D., Materials Engineering, Brown University, USA</td>
<td>Mechanical Behavior of Materials.</td>
<td>Material Technology and Tribology Research Lab.</td>
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<td>Jinn-Jyh Wang</td>
<td>Ph.D., Mechanical Engineering, Georgia Institute of Technology, USA</td>
<td>Design Modeling and Control of Machine Tools and Manufacturing Process and System.</td>
<td>Process and System Lab.</td>
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<td>Professor</td>
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<td></td>
<td>John-Ming Lin</td>
<td>Ph.D., Mechanical Engineering, University of Liverpool, UK</td>
<td>Laser Material Processing, Precision Engineering, Mechanics of Metal Working.</td>
<td>Laser Precision Engineering Lab.</td>
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<td>Professor</td>
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<tr>
<td></td>
<td>Chen-Kuei Chung</td>
<td>Ph.D., Material Sciences and Engineering, National Tsing-Hua University, Taiwan</td>
<td>MEMS, Fabrication and Process Integration of Micro-Nano Materials, Structures and Devices, Semiconductor and Electronic Engineering.</td>
<td>Micro-Nano Materials and Machining Lab.</td>
<td><a href="mailto:cckchung@mail.ncku.edu.tw">cckchung@mail.ncku.edu.tw</a></td>
</tr>
</tbody>
</table>
Graduate courses:
- Metal Physics
- Practical Metallurgy
- Machine Tool Dynamics
- Laser Material Processing
- Integration of MEMS Technology
- Special Topics in Plastic Forming
- The Technology and Application of Diamond Coating
- Failure Analysis
- Coating Technology
- Advanced Geometrical Optics
- Computer Integrated Manufacturing
- Introduction to Nano Technology

Research Labs

- **Metal Forming Lab**
  Metal Forming Laboratory is working on the research of metal forming system, including the manufacturability evaluation processes design, material formability and virtual machine tool.
  The research topics could be classified into four parts:
  2. Multi-Axis Machining and Virtual Machine Tool: geometric errors analysis, collision detection, cutting simulation and motion simulations.
  3. Remote Collaborative Virtual System for Surface Design and Manufacture: remote control and information exchange
  4. Bio-medical Manufacture System: Artificial femoral stem and Bi-curvature rod bending

- **Impact Lab**
  High velocity impact deformation of structural materials, Plasticity instability and adiabatic shearing, Deformation constitutive equations, Dynamic impact mechanics, Micro and Nanostructure analysis (SEM, TEM), Nanoindentation behavior and phase transformation of thin films.

- **Micro Analysis & Failure Diagnosis Lab**
  Micro Analysis and Failure Diagnosis Laboratory was founded in 1984 and became part of the Department of Mechanical Engineering at the National Chung Kung University. The laboratory focuses on developing the
cutting edge mechanical metals, electronic materials and ferrous materials. Currently available expertise ranges from techniques for process of material manufacture, Design Optimization, observing microstructure, analyzing component and failure diagnosis.

**Geometrical Optics Lab**

Professor Lin received his bachelor's and master's degrees from National Cheng Kung University (NCKU) in Taiwan respectively in 1979 and 1984, and PhD degree from the Northwestern University of USA in 1989. Upon graduation from Northwestern University, he has taught at NCKU for many years. His research areas include the analysis and synthesis of spatial mechanisms, error analysis and compensation of multi-axis machines, the design and machining of cutting tools, the development of geometrical optics. He has enjoyed his academic career, and received the distinguished professor position by NCKU in 2009.

**Material Technology and Tribology Research Lab**

Our lab mainly study the characteristic and tribological properties of the coatings using SEM, EDS, XRD, scratch tester, tribo-tester, then determine the optimal content of the coating for the use of industry.

**Process and System Lab**

- The Establishment of Spatial Error Compensation Technology for Micro/Meso Manufacturing System — Estimation of EDM Process Error
- The Effect of Uncut Chip Thickness on Quality of a Die-Sawing Process
- Fabrication of Wedge-Shape Tool via Electrochemical Micromachining with Diamond-Like Carbon Coating
- Experimental investigation and analysis of a single-crystal-diamond (110) tool edge sharpening process
- Minimum Quantity Lubrication (MQL)
- A stochastic grinding force model considering random grit distribution
- The ground surface roughness model considering machine vibration effect

**Laser Precision Engineering Lab**

- Laser micro-machining and forming.
- Analysis of the shock wave mechanism in laser materials processing.
- Laser assisted metal deposition and cladding.
- Laser welding for plastic and metallic materials.
- Plume effects in laser drilling with the jet flow at inclination angle.
- Laser drilling with the mask projection method.
- Laser-plasma hybrid processing for nano-manufacturing.
- The formation of micro/nano-particles in laser-enhanced electroplating method

**Micro-Nano Materials and Machining Lab**

- Micro-nano materials, machining and integration technology for structure pattern, sensor and actuator application;
- Advanced/Novel hybrid pulse anodization for the fabrication and application of porous anodic alumina (AAO) templates/films; Fabrication and characterization of nanoparticles and nanocrystalline composite films
- Novel CO2 laser machining and cutting for brittle and flexible materials together with laser annealing for material modification;
- Microfluidics chip development for simple planar mixer, pump and biomedical application
System and Control Division
<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Education Background</th>
<th>Research Area</th>
<th>Lab name</th>
<th>E-mail</th>
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<tbody>
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</tbody>
</table>
Graduate courses:

- Hydraulic & Pneumatic Control
- Robust Control
- Precision Machine and Control
- Feedforward Control
- Adaptive Control
- Random Dynamic Data Analysis and Process
- Biomechanics of Living Tissues and Cells

- Robotics Analysis & Control
- Linear Systems
- Mechatronic Project
- Nonlinear Control and Its Application
- System Modeling and Control

Research Labs

**Servo Control Lab**

The Servo Control Laboratory was established in 1990 by Prof. Mi-Ching Tsai, which the advanced research in the fields of motion control application and electric motor technology. The research focuses on the areas of industrial motion control, acoustic lifting control, power-assisted control, electric motor design, piezoelectric actuator design and robust control application. The purpose of the research is making differences in industries and human daily life.

**Fluid Power Lab**

M.C. Shih is presently a Distinguished Professor of Department of Mechanical Engineering at National Cheng-Kung University. His current research includes Energy Saving in Hydraulic Control System, Visual Control of Fluid Power System, Pneumatic Nano-accuracy Position Control in Biotechnology and Suspension System of Vehicle. An experimental chain of the series hydraulic hybrid vehicles is built by using hydraulic secondary regulating element (pump/motor), pump, accumulator and electric motor, etc.

**Optomechatronic System Control Lab**

The Opto-Mechatronic System Control Laboratory is focusing on developing novel visual servo systems for micro manipulations. Application of visual servo micromanipulations has been widely used in the microsystem development, information and semiconductor industry, and bio-medical areas. The challenge is to realize systematic integration of microscopic visual and mechatronic components for micro manipulations with high repeatability, accuracy, and speed. Typical research topics are micro gripping and transportation, micro pushing
and positioning, micro feeding, and automatic microassembly. Based upon the knowledge on mechanism, system control, visual servo, micro system, and precision engineering, the research activities include derivation and identification of dynamic models, development of visual servo algorithms, micro system design and implementation, and system performance test and evaluation.

- **Man-Machine System Lab**

  Established in 1987 the laboratory was called Control Laboratory with emphasis on application of control theories such as adaptive control and the fuzzy logic control to various mechanical systems such as above-knee prostheses, flexible arm and magnetic levitated structures. In 1997 when the department was relocated to current building, the laboratory was re-named Man-Machine Systems Laboratory (MML) with four missions: exploring interaction of human and machine systems, understanding biomechanics and control of human movements based on signals from sensory and motor system, integrating above knowledge to develop therapeutic devices or assistive devices, and investigating biomechanics of peripheral nerve from cellular level up to organ level. The lab has a close cooperation with the Neurology Department and Rehabilitation Medicine and Physical Therapy Department of National Cheng Kung University Hospital.

- **Maglev Control and Device Development Lab**


- **Robotic Systems and Control Lab**


- **Control and System Integration Lab**

  In Control and System Integration (CSI) lab., we work on system identification, system modeling, mechanism analysis, and controller design. In particular, we focus on utilizing smart materials for achieving precision positioning and tracking. Research results are applied on precision alignment, inspection, manufacturing and biomimetic fields.
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