

Han-Hsun Lu

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OBJECTIVE

Seeking a challenging position developing real-time control and modeling capabilities for advanced aerospace vehicles.

EDUCATION

TEXAS A&M UNIVERSITY | M.S. IN AEROSPACE ENGINEERING

College Station, TX

Expected May 2018

- Advisor: Dr. John Valasek
- Thesis: Online Near Real-Time System Identification on Small Unmanned Aircraft Systems

NATIONAL CHENG KUNG UNIVERSITY | M.S. IN ENGINEERING SCIENCE

Tainan, Taiwan

Sep. 2012 - Jan. 2014

- Advisor: Dr. Jer-Nan Juang
- Thesis: Robust Analysis of a Thin Spinning Membrane
- GPA: 4.0

TECHNICAL INTERESTS

System identification
Control law implementation
Intelligent systems and flight autonomy
Deep reinforcement learning

Sensor integration
Multi-agent control
Vehicle simulation and modeling
Vibrational modal analysis

EXPERIENCE

VEHICLE SYSTEMS & CONTROL LAB (VSCL) | GRADUATE RESEARCH ASSISTANT

College Station, TX

Sep. 2015 - Present

- Lead engineer for sensor integration and flight test avionics development on VSCL Unmanned Aircraft Systems (UAS). Responsible for developing flight computers and integrating sensors for multiple fixed-wing UAS. Main software and hardware developer for real-time vehicle modeling and control. Develop and update linear and nonlinear models for VSCL research aircrafts using both MATLAB®/Simulink and customized Python packages. Other duties include flight mission planning, serve as Ground Control Station (GCS) operator, and conduct flight data analysis.

NASA LANGLEY RESEARCH CENTER | STRUCTURAL DYNAMICS EXCHANGE SCHOLAR

Hampton, VA

Aug. 2012 - Aug. 2013

- Mentor: Dr. Lucas Horta
 - Structural Dynamics Branch
- Provided simulation results and identified linear models of a heliogyro flexible solar sail. The work was used to analyze the feasibility of a small scale demonstration mission by deploying and controlling a spinning solar sail. Conducted experiments using the 8-foot vacuum chamber to analyze the stability of flexible the solar sail beam in vacuum.

SYSTEMS AND CONTROL LAB (SCL) | GRADUATE RESEARCHER & LAB MANAGER

Tainan, Taiwan

Aug. 2013 - Aug. 2014

- Lead project engineer for flexible dynamical simulation and experiments at SCL.
Managed experiments and research at SCL.
Derived both uncoupled and coupled dynamics for flexible beam structures under the influence of solar pressure.
Developed predictive adaptive control algorithms for flexible structural control.

NATIONAL CENTER OF HIGH-PERFORMANCE COMPUTING | SUMMER INTERN

Hsinchu, Taiwan

Jun. 2011 - Aug. 2011

- Led a small webpage design group for a multi-platform educational website. Integrated Google App Engine with Python, HTML, and Javascript to develop a cloud based application.

RESEARCH PROJECTS

REAL-TIME SYSTEM IDENTIFICATION ON SMALL UNMANNED AIRCRAFT SYSTEMS

Sponsor: VSCL IRAD

Jun. 2016 - Present

- Thesis Research
- Development of a real-time UAS modeling system capable of updating linear vehicle models during flight test. Used a customized Python version of observer Kalman filter identification (OKID) to identify full aircraft dynamics of a 1/4 scale Supercub. Built a high frequency data acquisition system with the ability of directly measuring and logging data from multiple sensors at 100 Hz.
- Mentored undergraduate and graduate students implementing system architecture

FLIGHT TESTING OF INTELLIGENT MOTION VIDEO GUIDANCE FOR UNMANNED AIR SYSTEM GROUND TARGET SURVEILLANCE

Sponsor: VSCL IRAD

Jun. 2017 - Present

- A non-gimbaled camera system capable of tacking ground targets using Convolutional Neural Networks (CNN) for visual recognition. Implemented a Q-Learning algorithm for autonomous flight control that is capable of tracking moving ground targets for a long duration. COTS products were used and flight tests were demonstrated on a SUAS. My main contribution on the project is the avionics and flight control implementation.

SUAS PRECISION AGRICULTURE

Sponsor: Texas A&M College of Engineering / College of Agriculture

Sep. 2015 - Oct. 2016

- Developed a variety of fixed-wing UAS to carry multiple sensors for vegetation imaging and data collection. Modify and design vehicles for different payloads including DSLR, multi-spectral NIR, hyper-spectral, LIDAR and infrared sensors. My main responsibilities included flight planning, sensor tuning, image geo-tagging, DGPS implementation, and serve as a ground control operator (GCS).
- Mentored and trained a group of 6 undergraduate students for flight operations.

INFRASTRUCTURE ASSESSMENT USING UAS

Sponsor: Texas Department of Transportation / Texas A&M Transportation Institute

Sep. 2015 - Jun. 2016

- Established and demonstrated procedures with selected flight hardware that enable a small team to quickly perform infrastructure assessment tasks using UAS. Performed imaging flights with fixed-wing and rotorcrafts with sensors capable of collecting imagery for surface uniformity and condition analysis, runway vegetation encroachment, and pond algae identification.

TAILLESS AIRCRAFT CONTROLLER ANALYSIS

Sponsor: Air Force Office of Scientific Research

Jan. 2016 - Jun. 2016

- Assessment of the controllability of a tailless aircraft with a goal to design controller using a 55 inch F/A-18E Hornet UAV with 360 degrees thrust vectoring jet. The methods include Simulink modeling, wind tunnel testing, and actual flight test demonstration of a tailless F/A-18E UAV.

LIGHT WEIGHT HELIOGYRO SOLAR SAIL

Sponsor: Nasa Langley Research Center / National Institute of Aerospace

Aug. 2012 - Aug. 2013

- A next generation solar sailing concept exhibition project using solar pressure as main propulsion. Developed a discrete time model for the flexible beam dynamics and applied linear system identification to analyze the mode shapes of the structure. Analyzed an envelope of stability and applied model based predictive control with root piezocomposite active twist controllers to control the flexible blade using Matlab/Simulink. Showed that root twist controllers are feasible of stabilizing a flexible blade while providing good performance.

OPTIMIZED APPLICATION AND PRACTICE OF A* ALGORITHM FOR PATH PLANNING

Sponsor: Ministry of Science and Technology, Taiwan

Aug. 2011 - Aug. 2012

- Developed a bidirectional path planning algorithm reducing the open and closed nodes searched. The algorithm was implemented on a rover car and an Android cell phone for path finding.

TEACHING EXPERIENCE

TEXAS A&M UNIVERSITY | AEROSPACE ENGINEERING

- Assistant for AERO 321 Dynamics of Aerospace Vehicles
 - Responsible for flight dynamics laboratories in the Engineering Flight Simulator. Simulator experiments include virtual stability and control flight tests to perturb standard dynamic modes and experiments with coupled reduced static stability aircraft.
 - Responsible for grading and holding Q&A sessions.
- Assistant for AERO 422 Active Control of Aerospace Vehicles
 - Provided guidance on usage of MATLAB/ Simulink control law design for group projects.
 - Responsible for grading and evaluating student understanding of basic control concepts.

NATIONAL CHENG KUNG UNIVERSITY | ENGINEERING SCIENCE

- Assistant for Graduate Course Applied System Identification
 - Held tutorial sessions on mathematical coding for system identification.
 - Substitute lecturer on Math Models and Linear Systems.
- Assistant for Graduate Course Applied Control
 - Responsible for advising graduate students on weekly mini projects.
 - Responsible for grading and evaluating student understanding of modern control concepts including adaptive, LQR, and predictive control techniques.

TECHNICAL SKILLS

PROGRAMMING

- Proficient in MATLAB / Simulink through nonlinear dynamical simulations for both spacecraft and air vehicles.
 - Experienced with Control Systems Toolbox, System Identification Toolbox, Aerospace Toolbox, and NASA analysis toolbox System/Observer/Controller Identification Toolbox (SOCIT), System Identification Programs for AirCraft (SIDPAC).
 - Intermediate experience with structural modal analysis packages.
- Proficient in Python for mathematical estimation, microcontroller development, multiagent communication, and implementation of estimation and control algorithms through thesis research.
 - Advanced knowledge of mathematical packages SciPy, Numpy and Matplotlib.
 - Project experience with machine learning packages Keras, TensorFlow, and Scikit-Learn.
 - Project experience with computer vision package OpenCV.
- Strong knowledge of C/C++ developed through the implementation of real-time robotics and communication (UDP/TCP protocols). Embedded systems development experience such as Arduino, BeagleBone Black, and Raspberry Pi.
- Advanced knowledge of UNIX shell scripting.
- Project experience of webpage design and APP development languages.
 - Familiar with HTML5, CSS, Python, and Javascript for webpage design.
 - Familiar with Android and Java for APP design.

SOFTWARE APPLICATIONS

- Strong knowledge of LaTeX for paper publications.
- Advanced knowledge of MS Office.
- Advanced knowledge of Mathematica for math derivations through flexible structure derivation experience.
- Knowledge of MAVlink protocol.
- Knowledge of Labview for data acquisition and basic data analysis.
- Knowledge of Solidworks for rapid prototyping.
- Basic knowledge of X-plane.

LANGUAGES

- English: bilingual proficiency
- Chinese: bilingual proficiency
- Japanese: basic reading and speech

PUBLICATIONS

1. Goecks Vinicius, Lu Han-Hsun, Harris, Joshua, and Valasek John, "A Deep Learning Approach for Small Aircraft Self-Modeling and Autonomously-Adapting Controller." Ready for submission to The Thirty-Second AAAI Conference on Artificial Intelligence, Feb. 2018.
2. Lu Han-Hsun, Rogers, Cameron, Goecks Vinicius, and Valasek John, "Online Near Real Time System Identification on a Fixed-Wing Small Unmanned Air Vehicle." Submitted to AIAA Atmospheric Flight Mechanics Conference, Jan. 2018.
3. Lu Han-Hsun, Harris, Joshua, Vinicius Goecks, and Valasek, John, "Flight Test Instrumentation System for Small UAS System Identification." Unmanned Aircraft Systems (ICUAS), 2017 International Conference on. IEEE, Apr. 2017.
4. Valasek, John, Lu Han-Hsun, and Shi, Yeyin, "Development and Testing of a Customized Low-Cost Unmanned Aircraft System Based on Multispectral and Thermal Sensing for Precision Agriculture Applications." Unmanned Aircraft Systems (ICUAS), 2017 International Conference on. IEEE, Apr. 2017
5. Henrickson, James V, Rogers, Cameron, Lu Han-Hsun, Valasek, John and Shi, Yeyin, "Infrastructure assessment with small unmanned aircraft systems." Unmanned Aircraft Systems (ICUAS), 2016 International Conference on. IEEE, 2016.
6. Lu, Han-Hsun and Jernan, Juang, "Adaptive Control of a Heliogyro Membrane Blade" in 13th European Conference on Spacecraft Structures, Materials and Environmental Testing, Braunschweig, Germany, Apr. 2014.
7. Lu, Han-Hsun, Robust Control of a Spinning Thin Membrane, M.S. Thesis, National Cheng Kung University, Taiwan, Feb. 2014
8. Jernan, Juang and Lu, Han-Hsun, "Challenges Associated with System Identification and Control of a Heliogyro Membrane Blade", in 3rd International Symposium on Solar Sailing, Glasgow, Scotland, Jun. 2013.

LEADERSHIP

LAB MANAGER

Systems and Control Lab

Aug. 2013 - Aug. 2014

PRESIDENT

FCS Alumni Association

Jun. 2010 - Jun. 2011

- 300 member alumni association.

UNIVERSITY DELEGATE

National Cheng Kung University

Jun. 2010 - Dec. 2010

- Represent the university for forums and exhibitions on educational outreach.

PROFESSIONAL ORGANIZATIONS

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| • American Institute of Aeronautics and Astronautics (AIAA) | student member |
| • Institute of Electrical and Electronics Engineering (IEEE) | student member |

SELECTED COURSES

- Spacecraft Dynamics
- Modern Control for Aerospace Systems
- Dynamics of Aerospace Systems
- Estimation of Dynamical Systems
- Theory of Fluid Mechanics
- Stochastic Process
- Applied System Identification
- Fundamental System Engineering
- Robust Control
- Mechanics of Vibrations