Name: Pengcheng Wu

CONTACT INFORMATION

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RESEARCH INTERESTS

Dynamics, guidance and control for autonomous and unmanned vehicles, recently working on the data-driven path planning and control of multi-agent systems in the presence of uncertainty.

EXPERTISE AND SKILLS

- Dynamic modeling and experiments of mechanical systems
- Document processing and web design: **Word**, **Excel**, **LaTex**, **Html/CSS**
- Computer aided design: **AutoCAD**, **Catia**
- Image and signal processing: **ImageJ**, **Spider81**
- Finite element simulation: **Ansys**, **Abaqus**
- Programming language and numerical analysis: **Python**, **Matlab**, **Maple**
- State-of-the-art path planning and control algorithm and toolbox: **RRT**, **MCTS**, **PID**, **MPC**, **Simulink**, ...

EXPERIENCE

Program of Mechanical and Aerospace Engineering, UCSD joint with SDSU, CA, US

Research Assistant Aug. 2019 - Present

- Data-driven path planning and control of multi-agent systems in the presence of uncertainty
- Formulate chance constrained path planning to deal with uncertainty encountered by autonomous vehicles
- Propose a transformation of relative uncertainty to reduce the collision-avoidance problem
- Develop Markov Decision Process (MDP) and Monte Carlo Tree Search (MCTS) algorithms with continuous action space for the safe and efficient path planning of multi-agent systems
- Build a rapid, data-driven way to estimate the distribution of uncertainty through Kernel Density Estimation (KDE) and Fast Fourier Transform (FFT)

Department of Biomedical Engineering, UNC-Chapel Hill joint with NCSU, NC, US

Research Assistant Aug. 2018 - May. 2019

- CT image segmentation and signal processing using Matlab
- Filtering of high-frequency noise in CT images with FFT
- 3D reconstruction of CT images through ImageJ
- Geometric modeling and finite element analysis of a human arm using Ansys

State Key Laboratory of Mechanics and Control of Mechanical Structures, Nanjing, P. R. China

Research Assistant Apr. 2017 - Jul. 2018

- Dynamic modeling of rigid and flexible spacecraft models coupled with control moment gyroscopes
- Attitude maneuver and vibration control of spacecraft models using control moment gyroscopes based on model predictive control (MPC)

Shenyang Aircraft Corporation, Shenyang, P. R. China

Technical Intern Jul. 2013 - Aug. 2013

- Practice in casting, forging, machining, and producing of aircraft components
- Mechanical design of an airplane tail, structural strength calculation using Ansys, technical drawing using AutoCAD and Catia, technical reports writing of the airplane tail

EDUCATION BACKGROUND

Ph.D. Student August 2019 - present

University of California San Diego / San Diego State University

- Joint Doctoral Program of Mechanical and Aerospace Engineering
- Advisors: Professor **Jun Chen**, Professor **Sonia Martínez**
- Doctoral Qualifying Exam (DQE) passed
- Research Topic: Data-driven path planning and control of multi-agent systems in the presence of uncertainty

Nanjing University of Aeronautics and Astronautics

M.S., Dynamics and Control, Aerospace Engineering, April 2017

- Excellent Graduate Student
- Thesis: *Dynamic Modeling and Control for Space Structures Using Gyroscopes*
- Advisors: Professor Dongping Jin, Professor Hao Wen
- Area of Study: Dynamics and Control

B.S., Aerospace Engineering, June 2014

- Excellent Undergraduate Student
- Mechanics Specialization (with emphasis on structural strength and vibration)

HONORS AND AWARDS

- University Fellowship 2021-2022
- Admission into academic organizations AIAA, IEEE HKN Jan. 2020
- Excellent Student Scholarship 2017
- Award of Excellent Graduate Student Apr. 2017
- First prize in Mathematical Modeling Competition Jun. 2016
- Full Scholarship for Master Student Sep. 2014
- First prize in 4th Social Science Competition for Engineering Students Jun. 2013
- First prize in Fluid Mechanics Experiment Competition Dec. 2012

Academic Activities and Service

Publication Reviewer

- IEEE Transactions on Intelligent Transportation Systems
- American Control Conference
- IEEE International Conference on Control and Automation
- AIAA Scitech Forum
- AIAA Aviation Forum and Exposition

Conference Presentation

- AIAA SciTech Forum 2022 (coming)
- 16th IEEE International Conference on Control and Automation (October 2020)
- AIAA AVIATION Forum and Exposition (June 2020)

Academic Society Membership

- Student Member, AIAA (2020 - present)
- Student Member, IEEE HKN (2020 - present)

Teaching Assistant

- AE696 State Space Flight Control (Fall 2019-2021)

Publications

[1] Safety Assured Online Guidance with Airborne Separation for Urban Air Mobility Operations in Uncertain Environments, P. C. Wu, X. X. Yang, P. Wei, J. Chen. *IEEE Transactions on Intelligent Transportation Systems*. (Submitted)

[2] Risk-bounded Path Planning for Unmanned Aircraft System Operations under Uncertainty, P. C. Wu, J. F. Xie, Y. C. Liu, J. Chen. *IEEE Transactions on Intelligent Transportation Systems*. (Submitted)

[3] Comparisons of RRT and MCTS for Safe Assured Path Planning in Urban Air Mobility, P. Wu, J. Chen. *AIAA SciTech Forum*, San Diego, California, 2022. (Accepted)

[4] Safe Path Planning for Unmanned Aerial Vehicle under Location Uncertainty, P. C. Wu, J. F. Xie, J. Chen. *16th IEEE International Conference on Control and Automation*, Sapporo, Hokkaido, Japan, 2020. (DOI:10.1109/ICCA51439.2020.9264542)

[5] Probabilistic Guaranteed Path Planning for Safe Urban Air Mobility using Chance Constrained RRT*, P. C. Wu, L. Li, J. F. Xie, J. Chen. *AIAA AVIATION Forum and Exposition*, Reno, Nevada, 2020. (DOI: 10.2514/6.2020-2914)

[6] Attitude Maneuver Control and Vibration Suppression of Spacecraft with Flexible Appendages via Control Moment Gyroscopes (in Chinese), Wu, P. C. *M. Sc. dissertation*, *Nanjing University of Aeronautics and Astronautics*, 2017.

[7] Model predictive control of rigid spacecraft with two variable speed control moment gyroscopes, Wu, P. C., Wen, H., Chen, T., and Jin, D. P. *Applied Mathematics and Mechanics*, 38(11), 1551-1564, 2017. (DOI: 10.1007/s10483-017-2278-9)

[8] The attitude maneuver of a large space structure based on nonlinear model predictive control (in Chinese), Wu, P. C., Wen, H., Chen T., and Jin, D. P. *The 2nd Academic Conference of Deployable Space Structures*, Beijing, China, 2016.