CURRICULUM VITA

Chaoying (Paige) Pei

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Expertise

Control Theory (Optimal, Robust, Nonlinear)
Optimization (Convex, Nonconvex)
Feature learning
Entry, Powered Descent, and Landing Guidance

Education

- **Ph.D** Aeronautics and Astronautics, Purdue University, Expected Graduation: 08/2023
  - Topic: Multi-phase Optimization for Mixed-Integer Optimal Control
  - Advisor: Dr. Ran Dai
- **Master** Inertial Technology and Navigation Instruments, Beihang University, P.R.China, Graduation: 01/2018
- **Bachelor** Instrumentation and Optoelectronic Engineering, Beihang University, P.R.China, Graduation: 07/2015

Working Experience

01/2020-Present: Research Assistant, Department of Aeronautics and Astronautics, Purdue University

- Built an innovative model for atmospheric entry guidance problem by integrating the translational and rotational motion of an entry vehicle in a compact form represented by dual quaternions.
- Developed a hybrid Alternating Direction Method of Multipliers (ADMM) algorithm for solving large-scale Quadratically Constrained Quadratic Programming (QCQP) problems with a rigorously proved bounded error and linear convergence rate.
- Developed a multi-stage iterative algorithm based on Second-Order Cone Programming (SOCP) to solve the bang-bang optimal control problem and applied the proposed algorithm to the fuel-optimal powered descent guidance problem.
- Designed a distributed optimization framework for solving large-scale low-rank minimization problems that can be applied to solve a wide range of machine learning problems.
- Developed a smart-learning enabled and theory-supported paradigm to solve a broad class of optimal control problems with complex deterministic dynamical systems.

01/2018-01/2020: Planning and Control Algorithms Engineer, Baidu Inc, P.R.China

- Developed a low-cost and real-time path planning strategy based on state machine and geometric solution for automatic parking, which is used for real-world testing and mass production.

- Implemented an algorithm to guide the vehicle to cruise between the parking spots, while avoiding obstacles, stopping at specific stations, for a valet parking system.

09/2015-01/2018: Research Assistant, Department of Instrumentation and Optoelectronic, Beihang University, Beijing, P.R.China

- Developed offline path planning method for Unmanned Aerial Vehicles (UAVs) using genetic algorithm, digitally fused threat maps with actual maps, and improved the population initialization method and genetic factors.
- Proposed an improved D* algorithm for real-time path planning of UAVs, which combines the height information in the map and the cost function to realize the D* algorithm in three-dimensional path planning of UAVs.
- Designed a hover tracking controller based on fuzzy control for UAVs which keeps the moving target in the center of the on-board camera.
- Proposed a fast UAV planning and control method to guide the UAV to approach a moving ship from any place and finally fly follow the ship.
- Completed hardware design including microprocessor chips and multiple sensors for flight control circuit system of a tilting rotor UAV.

Journal Articles

- **C. Pei**, S. You, C. Sun and R. Dai, "Distributed Optimization for Rank-Constrained Semidefinite Programs[J]," in IEEE Control Systems Letters, vol. 7, pp. 103-108, 2023, doi: 10.1109/LCSYS.2022.3186939.
- **C. Pei**, C. Wan, R. Dai and J. R. Rea, "A Hybrid ADMM for Six-Degree-of-Freedom Entry Trajectory Optimization based on Dual Quaternions[J]," in IEEE Transactions on Aerospace and Electronic Systems, 2022, doi: 10.1109/TAES.2022.3223333.
- **C. Pei**, J. Zhang, X. Wang, et al. Research of a non-linearity control algorithm for UAV target tracking based on fuzzy logic systems[J]. Microsystem Technologies, 2018, 24(5): 2237-2252.
- V. Kenny, S. You, **C.Pei**, et al. Optimal Abort Guidance and Experimental Verification based on Feature Learning[J]. Journal of Aerospace Engineering (Accepted).
- Q. Zhang, X. Wang, X. Xiao, **C. Pei**. Design of a fault detection and diagnose system for intelligent unmanned aerial vehicle navigation system[J]. Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 2019, 233(6): 2170-2176.
- Q. Zhang, X. Wang, S. Wang, **C. Pei**. Application of improved fast dynamic Allan variance for the characterization of MEMS gyroscope on UAV[J]. Journal of Sensors, 2018, 2018.
- S. Wang, J. Zhang, Q. Zhang, **C. Pei**. An innovative fuzzy backstepping sliding mode controller for a Tri-Rotor Unmanned Aerial Vehicle[J]. Microsystem Technologies, 2017, 23(12): 5621-5630.
- Y. Zhang, Y. Guo, K. Li, **C. Pei**. Error-Compensation Method for Inclination Measurement Under the Influence of the Dynamic Interference[J]. IEEE Sensors Journal, 2015, 16(3): 734-741.

Peer Reviewed Conference Papers

- **C. Pei**, S. You, R. Dai, et al. Mixed-Input Learning for Multi-point Landing Guidance with Hazard Avoidance Part I: Offline Mission Planning based on Multi-Stage Optimization [C]//AIAA SCITECH 2023 Forum.
- S. You, **C. Pei**, R. Dai, et al. Mixed-Input Learning for Multi-point Landing Guidance with Hazard Avoidance Part II: Learning-based Guidance Algorithm [C]//AIAA SCITECH 2023 Forum.
- V. Kenny, S. You, G. Hendrix, **C. Pei**, et al. Feature-based Learning for Optimal Abort Guidance, [C]//AIAA SCITECH 2023 Forum.
- **C. Pei**, S. You, C. Sun and R. Dai. Distributed Optimization for Rank-Constrained Semidefinite Programs. 2022 IEEE Conference on Decision and Control.
- **C. Pei**, S. You, R. Dai, et al. A Unified Optimization Algorithm for Bang-bang Optimal Control[C]//AIAA SCITECH 2022 Forum. 2022: 0953.
- C. Wan, **C. Pei**, R. Dai, et al. Six-dimensional atmosphere entry guidance based on dual quaternion[C]//AIAA Scitech 2021 Forum. 2021: 0507.
- M. Jung, Q. Ze, **C. Pei**, et al. Enhanced Power Generation of Airborne Wind Energy System by A Foldable Aircraft[C]//AIAA Scitech 2021 Forum. 2021: 0868.
- V. Kenny, S. You, **C. Pei**, et al. Feature Learning for Optimal Control with B-spline Representations[C]//2022 American Control Conference (ACC). IEEE, 2022: 2917-2923.
- **C. Pei**, J. Zhang, X. Wang, et al. A Method of Path Planning and Control Strategy for Carrier-Based UAV in Return Section[C]//2017 2nd International Conference on Automation, Mechanical and Electrical Engineering (AMEE 2017). Atlantis Press, 2017: 9-17.

Services

Paper Review:
2021-2023 American Control Conference (ACC)
2021-2022 IEEE Conference on Decision and Control (CDC)
Journal of Guidance, Control, and Dynamics
IEEE Transactions on Aerospace and Electronic Systems
Organization: 2021 IEEE Conference on Decision and Control (Volunteer Organizer)

Awards and Honors

- 2022: Bilsland Dissertation Felloship (prestigious funding program supporting exceptional doctoral students in their dissertation research at Purdue University)
- 2013: Champion of Vertical Takeoff and Landing in the 23rd National Model Aviation Championships.
- 2014: Third Prize of the 24th Feng Ru Cup Electromechanical Team of Beihang University.
- 2013: Second Prize of American Mathematical Modeling Competition

Professional Societies

- 2021-Present: Member of American Institute of Aeronautics and Astronautics (AIAA).
- 2022-Present: Member of Institute of Electrical and Electronics Engineers (IEEE).
- 2022-Present: Society of Women Engineers member.