Ce Hao

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Education

Department of Mechanical Engineering, UC, Berkeley (Berkeley)   09/2019 - Present
Visiting Graduate Student of Mechanical Systems Control Lab
Research Topic: Trajectory planning and controller for autonomous racing vehicle

School of Astronautics, Beihang University (Beijing)   09/2018 - Present
Master Candidate of Control Theory and Engineering
GPA: **87.17/100**; TOELF: **102** (R27, L30, S23, R23); GRE: **326** (V156, Q170, AW3.5)

School of Astronautics, Beihang University (Beijing)   09/2014 - 06/2018
Bachelor Degree of Guidance Navigation and Control
GPA: **3.8/4.0**; Ranking: **Top 1/220**; Golden Medal Award Winner (**Top 10** in 4200 students)

Publication

➢ Song, Jia, **Ce Hao**, and Jiangcheng Su. "Path planning for unmanned surface vehicle based on predictive artificial potential field." International Journal of Advanced Robotic Systems 17.2 (2020)
➢ Jia Song, **Ce Hao***, Ke Gao, Erfu Yang. Parameter Identification of Racing Vehicle Dynamic Model based on Forgetting Factor-Recursive Least Square. IEEE World Congress on Computational Intelligence (WCCI) 2020. (Submitted)
➢ Song, Jia., **Ce Hao**., Zhang, Y., Yu, N., Liu, Y., & Yang, E. (2019, July). Double-Loop Sliding Mode Control of Reentry Hypersonic Vehicle with RCS. In 2019 IEEE 15th International Conference on Control and Automation (ICCA) (pp. 109-114). IEEE.

Research Experience

Mechanical Systems Control Lab at University of Californimenerentt a, Berkeley
Research Assistant, Supervisor: **Prof. Masayoshi Tomizuka**   09/2019 - Present
Racing Trajectory Planning and Model Predictive Controller of Autonomous Racing
Autonomous racing gradually earns its popularity with the autonomous driving technology. Sony Interactive Entertainment supported this project to beat human and intelligent AI players in the GTS racing car simulating platform.

➢ Proposed the novel longitudinal/lateral dynamics and engine model for racing vehicle, which contain tanh tire model to fit saturating character to replace brush tire model and online parameter identification algorithm for inertia, lateral tire stiffness and engine torque map.
➢ Designed iterative model-based trajectory planning and model predictive controller for racing vehicle at the limit of handling in real time.
➢ The novel controller can easily adapt to different tracks and cars and simultaneously explore latent action to perform better than human players.
➢ Developed Matlab/Carsim and Python simulator and implemented racing MPC with C++ interfaced solver to manipulate racing vehicle in real-time. The result validated the **lap time is better than human best record** by 4.7% at each lap.

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Key Laboratory of Spacecraft Design Optimization and Dynamic Simulation Technologies
Research Assistant, Supervisor: **Prof. Jia Song**, Beihang University   11/2017 - 06/2018
Design of RCS Aircraft Control System based on Nonlinear Sliding Mode Control

When aircraft flies across the atmosphere, the thin air cannot provide sufficient aerodynamic force. Therefore, thrusters are necessary and reaction control system (RCS) must be taken into consideration.

➢ Established general reentry aircraft Winged-Cone model and its 6-DOF twelve state equations.
➢ Designed the fractional sliding mode control (SMC) equation based on Lyapunov stability criterion and implemented in Simulink.
➢ Verified the reentry attitude stabilization, showing that it had stronger robustness against external environmental disturbances and finite unknown fault.

Digital Navigation Center of Beihang University
Research Assistant, Supervisor: **Prof. Long Zhao**   02/2017 - 08/2018
Design of GPS/INS Combined Navigation System for Racing Vehicle Positioning

Embedded inertial navigation system (INS) has become an important navigation component of electronic device. However, the accuracy of commercial IMU is relevantly poor, so the combined filtering algorithm is necessary to improve the accuracy and resist interference.

➢ Designed and developed the inertial navigation (IMU) platform based on MPU9250 and STM32F103 with I^2C bus protocol.
➢ Proposed GPS/INS integrated navigation filtering algorithm and adopted EKF and digital low-pass filleter to reduce white noise interference.
➢ Installed the commercial MEMS IMU platform on racing vehicle with high velocity and successfully acquired the accurate position within 10m on the global coordinate.

Internship

No Barriers **Entrepreneurial Firm**
Hardware Engineer   04/2017 - 06/2018
Sign Language Electromyographic (EMG) Signal Acquisition based on CNN

Sign language as the common way to communicate with mute people is usually recognized by images, which require constant camera monitor and less portable.

➢ Designed STM32L476 single chip micyoco PCB and EMG sensor. Used the 50Hz digital wave trap to remove the alternating current interference.
➢ Built a seven-layer convolutional neural network (CNN) framework by Keras and extracted signal features to achieve action recognition for 50 typical sign languages.

Additional Information

Awards: Chinese National Scholarship, 1st Prize of National Entrepreneurship Competition
Programming Language: Matlab/Simulink, Python (Tensorflow, Keras, CVX), C++ (OpenCV)
Mechanical Design and Simulation Software: Solidworks, AutoCAD, Adams, Carsim
Electric Design Software: Altium Designer, Keil (Verilog HDL), Labview