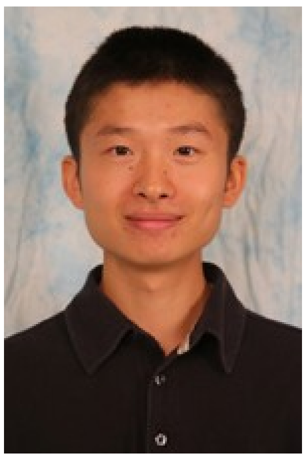
The Field Robotics Center

Seminar Series

Thursday, 17th March **GHC 2109 11:00am – 12:00pm**



Lunch will be served

John Yao
Ph.D. Student
Robotics Institute

Improving the Precision of Aerial Robot Infrastructure Inspection Through Aerodynamic Disturbance Inference

Abstract: The use of aerial robots to inspect bridges, buildings, and other types of infrastructure is becoming widespread due to their advantages in providing sensor mobility, enabling consistent data collection over long time intervals, and improving the safety of human inspectors. Inspection missions require aerial robots to fly outdoors in close proximity to inspection targets, often under conditions where freestream wind and surface-induced airflow adversely impact flight performance.

First-principles computational fluid dynamics techniques for predicting the influence of aerodynamic disturbances on vehicle dynamics are generally too computationally expensive to run online, limiting their utility for inspection.

We develop a regression-based strategy to predict aerodynamic disturbances based on the vehicle's velocity, the geometry of its surrounding environment, and the freestream wind. Disturbances encountered in past flight experiences are used to train a model for predicting disturbances along potential inspection paths, which can be used in cost functions that enable planners to generate trajectories adapted to local aerodynamic conditions. To allow the model to generalize across different environments, we develop descriptors that parametrize a class of rectangular geometries commonly encountered in engineered structures.Towards demonstrating the applicability of the proposed approach in outdoor inspection scenarios, we show preliminary results from flight tests in tunnel-like environments as well as in artificially generated wind under laboratory conditions.

Speaker Bio: John Yao is a Ph.D. student in the Robotics Institute at Carnegie Mellon University, advised by Dr. Nathan Michael. He received a B.A.Sc. in Engineering Science (Aerospace Major) from the University of Toronto in 2013.He is interested in applying inference-based approaches to improve state estimation and control for vehicles with dynamics that are significantly affected by stochastic, spatially varying environmental forces.

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