

Unified Meta-Representation for General Disturbance Estimation

One Controller, All Disturbances

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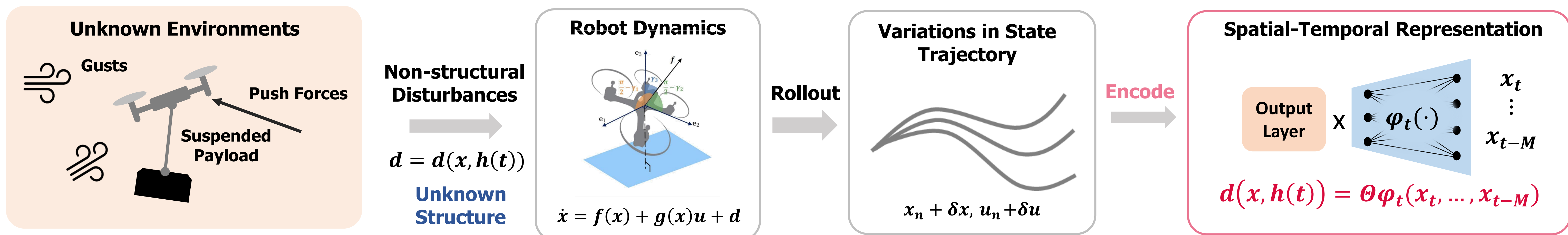


Project Site

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Motivation: One Controller for Various Unknown Disturbances



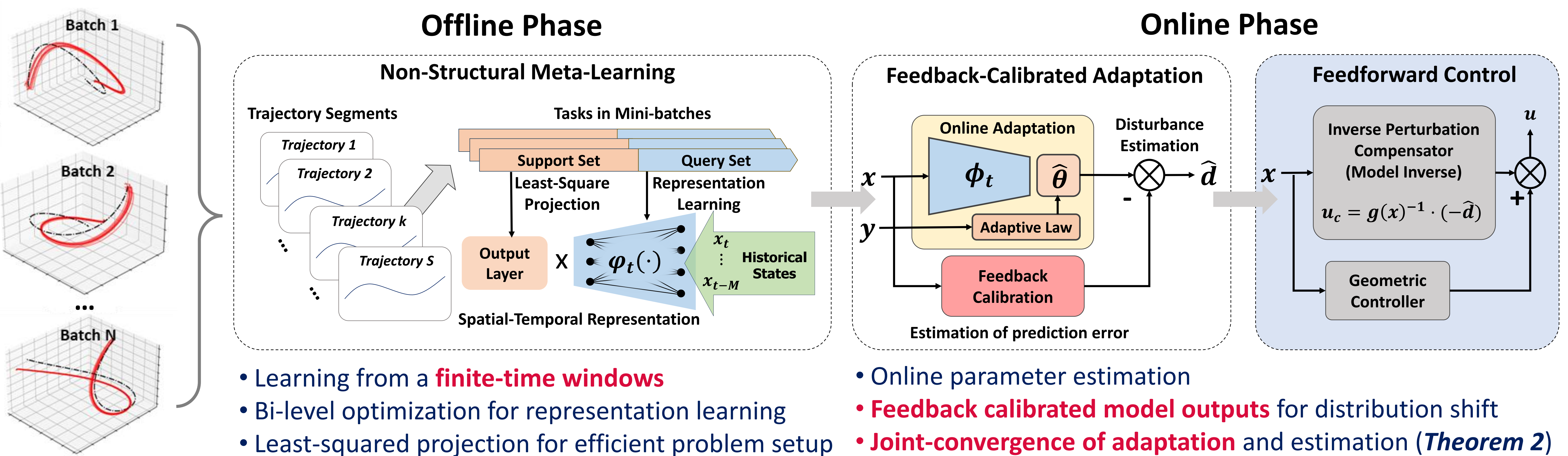
Modelling of disturbances:

- $h(t)$: Environmental inputs, e.g. wind speed
- x : State-related parts, e.g. speed and attitude

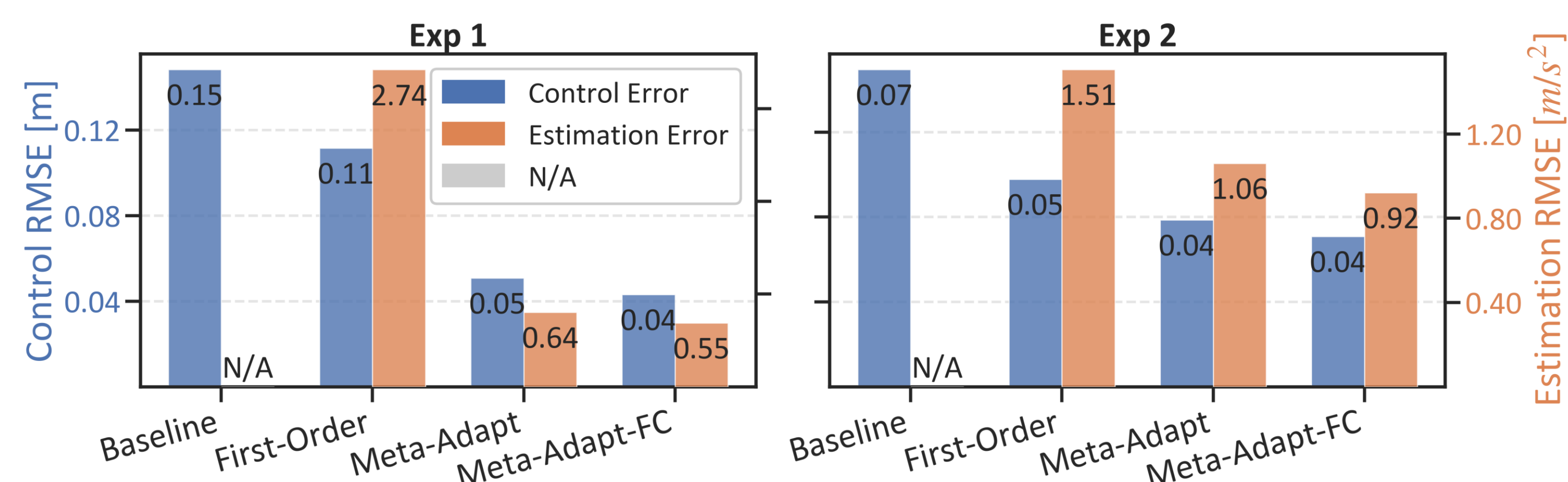
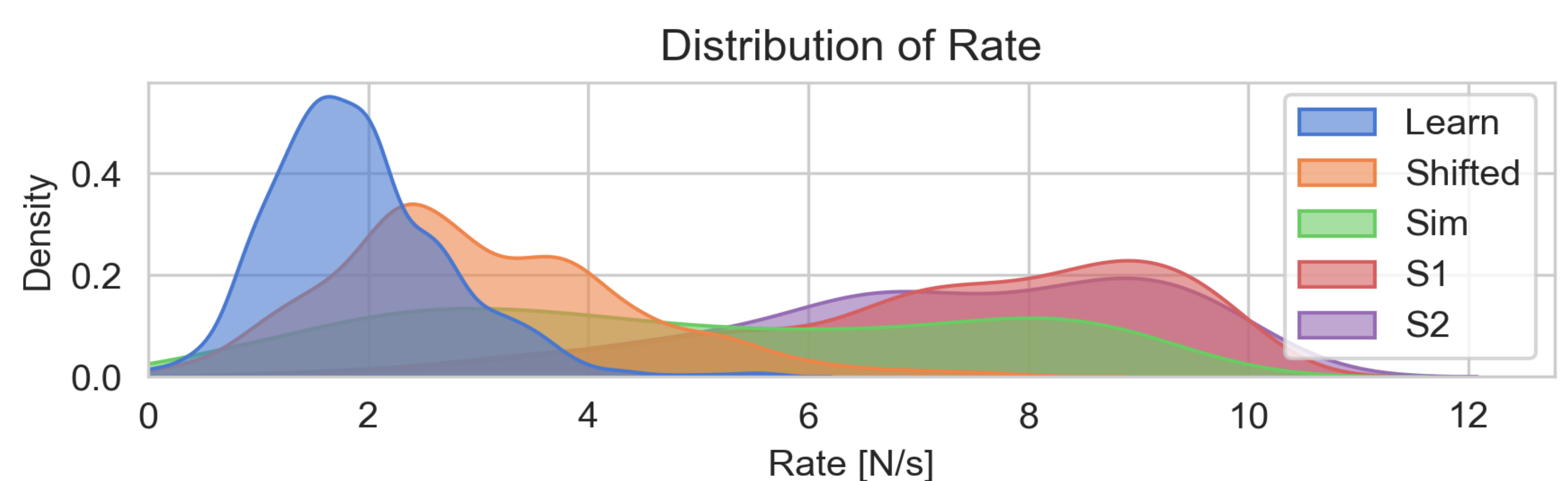
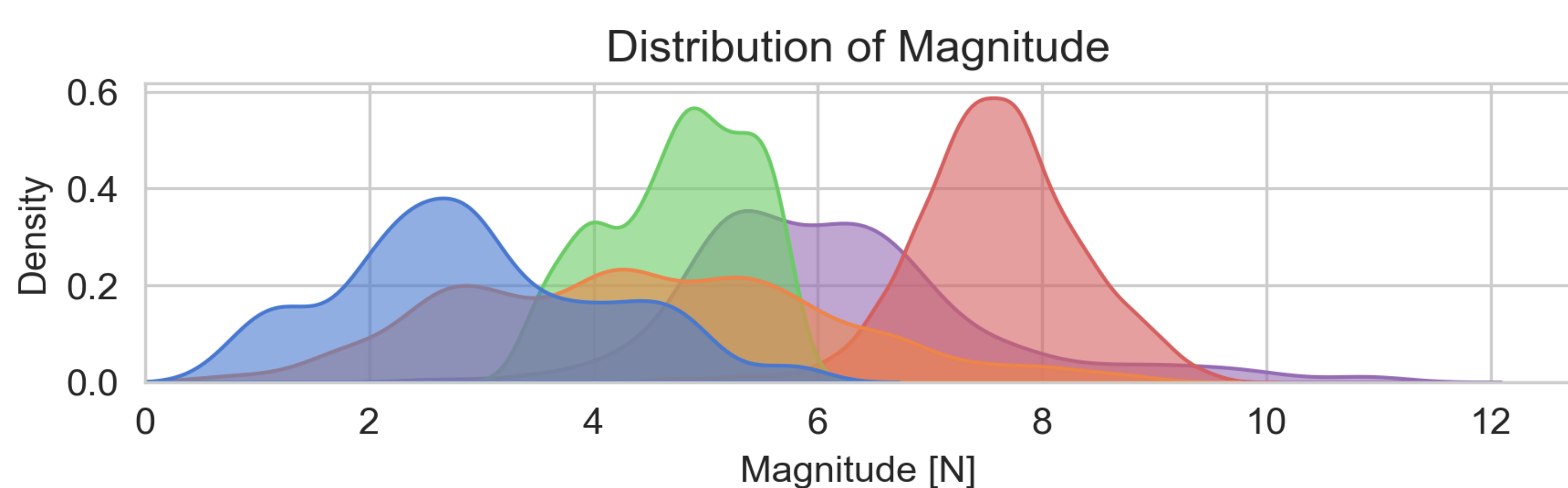
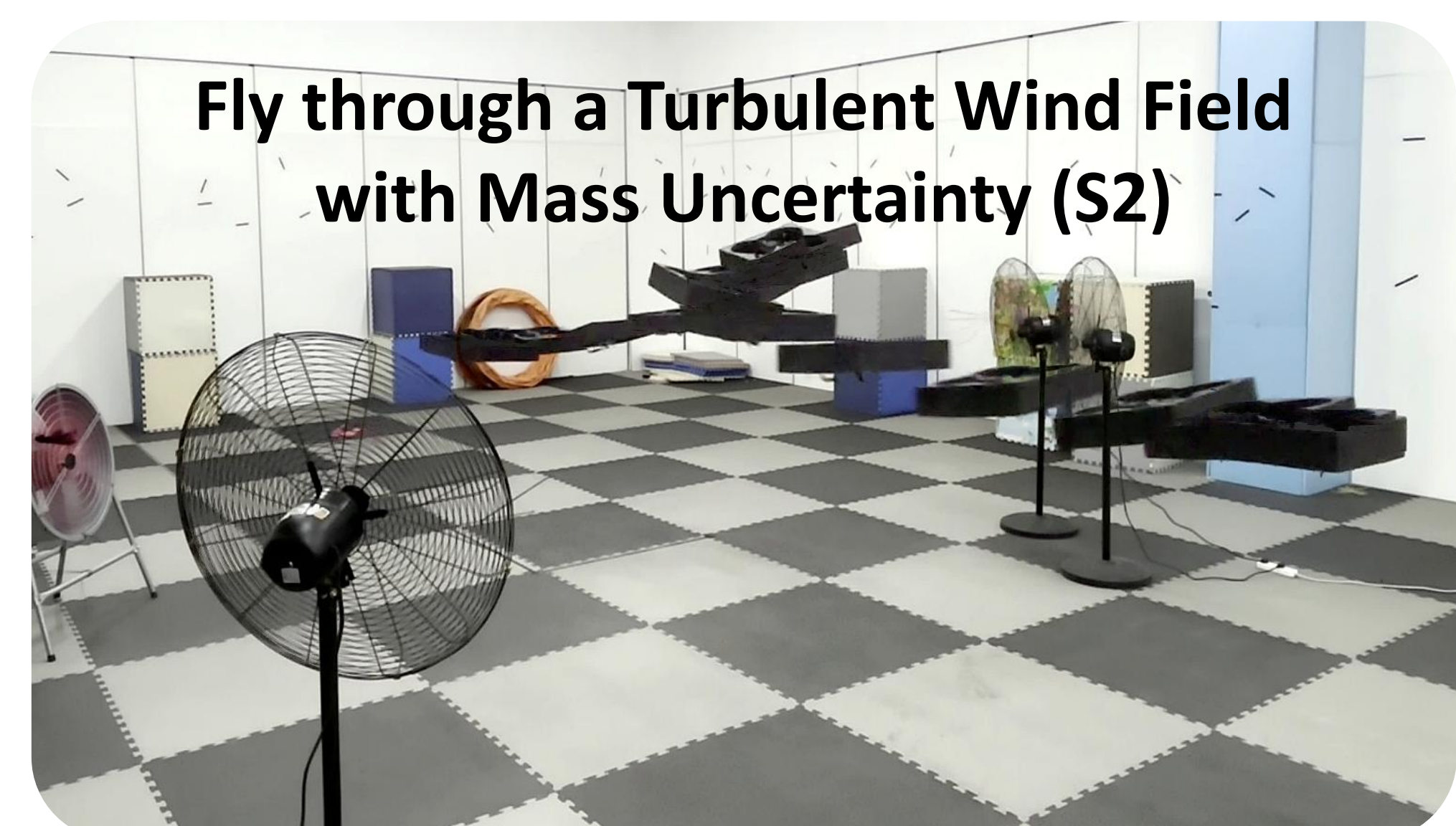
Representation of disturbances:

- Simulated via **random polynomial series**
- Represented via historical state buffer

Contribution: Generalizable Controller for Arbitrary Continuous Disturbance



Real-World Test: One Controller Across 3 Scenarios



- **Large distribution shift** between simulated disturbance (for learning) and real-world cases,
- Meta-learning from **finite-time windows** ensures generalizability,
- **Feedback Calibration** further reduces representation loss under distribution shift.

Future and Open Problems

- (1) Estimation should be done under the capability of low-level controller,
- (2) Learning under the online adaptation mechanism,
- (3) **Integration with RL policies for contact-related dynamics.**

Stay Tuned!

