Learning a stable controller from sparse wind-farm data

Maya de Vries · Data-Driven Controls · Delft University of Technology

Summary

Question. Can a controller learn a useful wake model when the available measurements are sparse and the wind direction changes quickly? We combine a low-order physical model with an uncertainty-aware update rule. The result is a compact research narrative suitable for the DCSC poster structure; replace each block with your own contribution.

Motivation

Wind-farm control is a coordination problem: a local action changes the measurements available to every downstream turbine. A poster should expose the decision, the evidence, and the limitation without making a reader hunt through dense paragraphs.

- measurements are irregular and partly missing;
- the controller must remain safe while it learns;
- the uncertainty estimate is reported with the performance gain.

Case study

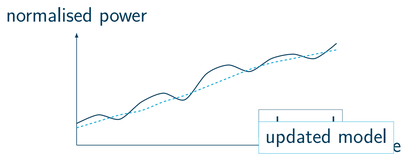
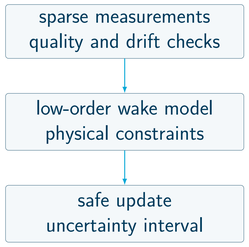


Figure 1. Observations and the updated model over one test window.

Method



Results

Strategy	RMSE	energy gain	unsafe actions
fixed baseline	0.184	0%	0
adaptive model	0.121	8.6%	0
oracle reference	0.098	10.2%	0

The adaptive model improves the objective while preserving the safety envelope. The gain falls to 3.1% when the wind-direction sensor is deliberately delayed by two samples.

Take-away

Model the uncertainty before optimising the headline metric.

The template's section bars, portrait A0 canvas, two-column flow, and bottom project banner are ready to customise.