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Abstract

This article presents a kite control and optimization problem intended as a benchmark problem for advanced control and optimization. We provide an entry point to this exciting renewable energy system for researchers in control and optimization methods looking for a realistic test bench, and/or a useful application case for their theory. The benchmark problem in this paper can be studied in simulation, and a complete Simulink model is provided to facilitate this. The simulated scenario, which reproduces many of the challenges presented by a real system, is based on experimental studies from the literature, industrial data and the authors' own experience in experimental kite control. In particular, an experimentally validated wind turbulence model is included, which subjects the kite to realistic disturbances. The benchmark problem is that of controlling a kite such that the average line tension is maximized. Two different models are provided: A more comprehensive one is used to simulate the 'plant', while a simpler 'model' is used to design and implement control and optimization strategies. This way, uncertainty is present in the form of plant-model mismatch. The outputs of the plant are corrupted by measurement noise. The maximum achievable average line tension for the plant is calculated, which should facilitate the performance comparison of different algorithms. A simple control strategy is implemented on the plant and found to be quite sub-optimal, even if the free parameters of the algorithm are well tuned. An open question is whether or not more advanced control algorithms could do better.

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