A kite-based generator for airborne wind energy: modelling and optimisation

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Using kites to collect wind power and generate energy has been intensively studied in the last decade, see *e.g.* the survey by M. Diehl *et al* in [1]. In the framework of the KEEP (Kite Electrical Energy Power) funded by CNRS and gathering researchers from ENSTA Bretagne (well acquainted with the topic after previous studies on kites [2], most notably for boats [3]) and Université Côte d'Azur, we are interested in the analysis of a simple device composed of a kite attached to an arm; having the kite running along a well chosen curve will move the arm and generate electric power. We first build a simple point-mass mechanical model where the kite motion is prescribed to a conical surface modelled on an eight curve. The resulting differential equation can be expressed either as (i) a 5-dimensional second order DAE, or (ii) a dimension 2 second order ODE. For well chosen initial conditions, numerical integration of these two equivalent descriptions exhibit a limit cycle. We report on the optimization of the parameters of the device to maximize power on the limit cycle, as well as a validation of our approach using a third party trusted library [4].

References

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