Airborne Wind Energy (AWE) refers to systems capable of harvesting energy from the wind by flying crosswind patterns with a tethered aircraft. Tuning and validation of flight controllers for AWE systems depends on the availability of reasonable a priori models. Due to the non-conventional structure of the airborne component, an intensive flight test campaign must be set in order to gain additional insight about the aerodynamic properties.

In this paper, several aspects related to the system identification of the airborne component of a rigid wing AWE pumping system are provided. The studies rely on the second prototype AWE system developed by Ampyx Power B.V.

More precisely, aerodynamic coefficients are estimated from real flight tests using an efficient multiple-experiment model-based parameter estimation algorithm [1]. Mathematical models rely on the full six degree of freedom aircraft equations of motion. Both model selection and estimation results are assessed by means of R-squared value and confidence ellipsoids.

Subsequently, optimized maneuvers are computed by solving a model-based experimental design problem that aims to obtain more accurate parameter estimates and reduce the flight test time [2].

Finally, several theoretical and practical aspects of the proposed methods are provided.

References: