

## 1 Rotor blade aerodynamics

- (a) How can you minimize the induced drag of a wing of given span?
- (b) How can you minimize the induced drag of a wind turbine rotor blade of given span?
- (c) What is the consequence of minimizing the induced drag of a wind turbine rotor blade?

## 2 Propeller and rotor blade design

Explain why a propeller blade (roughly) has an elliptic shape, while the shape of a modern wind turbine rotor blade is (roughly) trapezoidal?

## 3 Comparison of wind turbine and cross wind kite energy system

Give three similarities and three dissimilarities between a Savonius rotor and an energy extracting cross wind kite.

## 4 Kite structural dynamic and aerodynamics

- (a) What is the aerodynamic effect causing indentations of the leading edge of a ram-air wing?
- (b) What is causing the effect of “ballooning” of a ram-air wing?
- (c) Describe concisely two important global deformation modes of an arc-shaped kite.
- (d) Which dynamic coupling effect is causing canopy flutter?

## 5 Kite design

- (a) What is the function of the bridle system of a Leading Edge Inflatable (LEI) kite used for power generation?
- (b) How can the de-power performance of a kite be quantified in an experiment? Describe a simple setup which requires no extra hardware.
- (c) How can the Lift/Drag ratio of a standard Leading Edge Inflatable tube kite be increased? Propose two design measures which can be implemented with low effort.
- (d) What are the contributions of Lift and Drag when increasing the Lift/Drag ratio of a kite? Which of the two properties is changing more? Explain why?

## 6 Kite Power System

- (a) What is the fundamental advantage of a high Lift/Drag ratio when considering power generation in cross wind mode?
- (b) What is the qualitative effect of the cross wind factor  $x$  on the elevation angle  $\beta$ ?
- (c) What is the qualitative effect of the Lift/Drag ratio on the elevation angle  $\beta$ ? Consider a conventional static kite without reel-out of the cable and without crosswind operation.