

Unsteady BEM for VAWT

This exercise deals with a Vertical Axis Wind Turbine, VAWT and how to estimate the time dependent loads using an unsteady BEM approach, **as described in the lecture notes.**

$R=3\text{m}$, $V_o=8\text{m/s}$, $\omega=12 \text{ rad/s}$, $B=2$, $\rho=1.225 \text{ kg/m}^3$, $\theta_p=0$, $S=B \cdot c/R=0.2$. The airfoil data are given in the file airfoil.txt.

Q#1: Compute and plot as function of time $p_{t,B=1}$, $p_{x,tot}$, $p_{y,tot}$, C_T and C_p . Wait until the solution becomes periodic and estimate the time averaged C_T and C_p

$p_{x,tot}(t)$ and $p_{y,tot}(t)$ are the sum of the loads from all blades at time, t , in x and y direction, respectively and is the load felt by the tower.

$p_{t,B=1}(t)$ is the tangential load experienced by only blade #1.

Q#2: Now add one blade so $B=3$, but keep the solidity at $S=0.2$. Plot $p_{x,tot}$, $p_{y,tot}$ and explain the difference in the loads experienced by the tower. Compare the time averaged C_T and C_p with the 2 bladed VAWT having the same solidity.