**Assignment Day 1**

The goal of this assignment is to explore some of the concepts that we learned in the lectures in more depth. At the end of the course **(Day 4)**, you as a group will prepare a presentation based on the questions in this assignment. Each group will be given a unique turbine model.

*Question 1: Examples of open-loop and closed-loop system*

Show one real-life example of open-loop control AND one example of closed-loop control. Justify why you think the examples you provided are open-loop and closed-loop.

*Question 2: Calculate the optimal gain (K\_opt) for your turbine model and implement the generator torque controller in Region 2*

First, calculate the optimal gain (K\_opt) for your turbine model. The turbine parameter can be found in ‘InitWT\_NREL5MW.m’.

Step wind test

Second, open ‘Q2\_NREL5MW.m’. Input your calculated K\_opt values. Then, perform a step wind test (wind\_no = 1) and see if you achieve the maximum Cp and lambda. (Tip: you can find maximum Cp and lambda values in the structure called ‘turbine’)

Turbulent wind test

Third, open ‘Q2\_NREL5MW.m’. Change the wind file to turbulent wind speed around 8 m/s (wind\_no = 1), Calculate the AEP (annual energy production) for 10 min between 100s and 700s (sim.Tend = 700).

Now, let’s investigate other K\_opt values. Multiply your calculated K\_opt value with 0.99 or 1.01. Do you see a bigger value for the AEP? Why is that? Can you find a better K\_opt that produces higher AEP? How about the loads on the tower fore-aft motion (mode = 'omega+tower')?