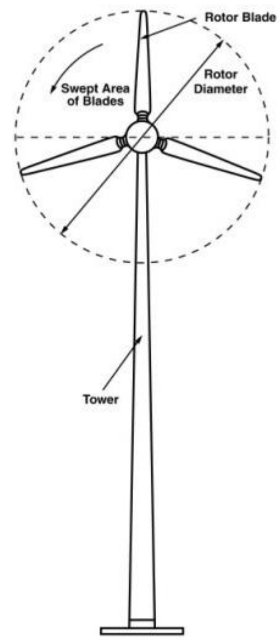
ENGINEERING H192
DAILY ASSIGNMENT B20



Energy can be extracted from the wind and converted into electricity through the use of wind turbines. The difference in the velocity of wind upstream and downstream of the turbine blades is directly related to the power produced by the turbine, as stated in the following equation:

$$P = \frac{1}{4}\rho A V^3 \left(1 + \frac{V_o}{V}\right)\left[1 - \left(\frac{V_o}{V}\right)^2\right]$$

where **P** is the power in [watts], **ρ** is the air density in [kg/m^3], **A** is the rotor swept area in [m^2], **V** is the upstream wind velocity in [m/s], and $\mathbf{V_0}$ is the downstream wind velocity, also in [m/s].

In order to analyze different sizes of a particular rotor design, we would like to compare the power developed by the turbine at various wind speeds. It has been determined that the average downstream wind velocities generated by this design can be approximated by the following function:

$$V_0 = V - \frac{3}{2}V^{1/2} * \sin\left(\frac{\pi}{25}V\right)$$

This approximation is only valid for the turbine operating at upstream wind velocities below 20 m/s. For this problem, assume the turbine is at sea level, where air density, **ρ**, is 1.225 kg/m^3. Rotor swept area, **A**, is related to the rotor diameter, **d**, by $A = 0.25\pi d^2$.

Write a **MATLAB** script that will plot P vs. V, for rotor diameters of **d** = 12 m, 15 m and 18 m. The plot should only include values of V for which the equation is valid, i.e. $0 \le V \le 20$. All three plots should appear on the same figure, so you will have to incorporate MATLAB's **hold on** command. Save your script as **b20.m**.

When your script is working and producing correct results, print the script and the plot and submit them with this sheet.

Name________________________________**Instructor**__________________**Seat**______**Hour**______