

AE 1601 Wind Tunnel Testing

Ceiling Fan Blade

The purpose of the wind tunnel testing is to provide an exposure to the experimental testing. The test object is a ceiling fan blade with an approximate rectangular planform. Each test run (excel file) corresponds to a particular angle of attack and the speed. The Excel file names are named accordingly. Each team is required to run four different speeds (4, 8, 12, 16 m/s) for a given angle of attack. The data from all different groups will be shared with everyone else by the professor, so that you can get data at different angles of attack.

Things to note down before acquiring the data:

1. Record the temperature and pressure before you start the test; you will need this to compute the density and viscosity of air.
2. Verify the wind tunnel speed with the one that your group is assigned to.
3. Give the file name in this format, **AE1601_AOAxx_YYmps.xls**. Make sure not to miss the '.xls' extension to your file name. For example, if your group is running for 4 degrees angle of attack, at 16 m/s, the file name would be, AE1601_AOA04_16mps.xls.
4. For each test case, write down the Lift and Drag values that will be displayed on the screen. You can verify these values at a later point from the shared excel files.

Data reduction:

1. Total lift (L_T): Find the average and standard deviation for Lift values that are recorded in Pound-force (Lbf). The first column in the excel file.
2. Test stand (L_S): Find the average value for lift and drag values from the test stand measured in Lbf units (first column in the excel file). There would be four Excel files for different speeds, make sure to use the right one for each test case.
3. Lift on fan blade (L_W) = $L_T - L_S$
4. Obtain lift coefficient (C_L). (Note: use consistent units)
5. Plot C_L Vs AOA (degrees). Experimental data should be denoted by 'dots' and not a continuous line. Report the standard deviation for each measurement as an error bar.
6. Obtain a curve fit in the linear region and report the slope of the equation in per radian units.
7. Repeat 1-6 for different speeds and identify each plot with their corresponding Reynolds number.

Fan Blade Parameters	
Span (m)	0.47
Chord (m)	0.12
Planform area (m ²)	0.06123

