

57:020 Mechanics of Fluids & Transfer Processes

Airfoil

Establish first a targeted Reynolds number for the experiment.

Some of the scanivalve's ports are damaged. Ask for the new the connexions which were made to fix the problem.

- (1) Turn on the Digital Voltmeter (DVM), the Validyne Signal Conditioner, and the Scanivalve Positioning Circuit all located to the left of the computer in front of the open test section.
- (2) Turn on the computer.
- (3) Turn on the wind tunnel by pressing the green start button located to the left of the open test section. Adjust the tunnel fan speed by rotating the turn shaft to the right of the start button for at least eight complete revolutions. Allow the speed of the tunnel to stabilize.
- (4) Double click on the icon located on the far top right corner of the computer screen named UHIL Lift. This is a Virtual Instrument (VI) created for automatic data acquisition.
- (5) Yellow boxes designate input values and blue boxes contain the results which appear only after the completion of the data acquisition process. Determine the total number of points you would like to sample and input that value in the yellow box in the middle of the screen labeled: No. of Obs Points.
- (6) Each point sampled corresponds to a port on the scanivalve, type in all the port numbers corresponding to each sample point in the yellow boxes provided in the middle of the screen.
- (7) Decide on the Sampling Rate (Hz), Settling Time (s), and Length of each Sample (s) values and input them into the boxes on the upper right corner marked appropriately.
- (8) Type in the density of the fluid used for calibration of the Validyne pressure transducer, as well as the slope and the intercept for the conversion equation which converts voltage to total pressure.
- (9) Type in the angle of attack (degrees) desired for each run.
- (10) Run the VI by clicking on the arrow button to the far top left of the screen.
- (11) Repeat steps nine and ten for two additional angles of attack.

(* Helpful Hints *)

- In general for the VI software blue boxes are results, yellow boxes are input, and green boxes are advisory to watch for its changing values. "Show Help" gives a screen with comments about each component of the VI.
- If you choose measurements for the observed points to be 10 seconds or greater a window will display the seconds remaining.
- All the data collected is stored in the following directory: D:/Lib/Libs/VHIL/DATA.
- The date and time is fixed on the name of the data file when the GO button is pressed, a dialog box comes up with filename. All output files are microsoft excel ready for the students.
- Must zero the multimeter before data collection.

- After the experiment is complete the LHS of the screen with the blue boxes will fill up with the data from the total number of ports sampled, you may scroll through the data before the next collection.
- Because the naming system of the output files is by date and time, if less than a minute goes by between groups the computer will save both groups to one file with the same name.

(* Calibration *)

- Turn-on the equipment and zero the multimeter span setting.
- Turn-on validyne positioning circuit to port 42 (manually).
- Turn-on wind tunnel to maximum operating speed by rotating the handwheel 20 turns to the right, and then set span to +5 volts on the multimeter.
- Turn-on the computer and open VI: D:/IIHR.lib/IIHR.libs/RefCond.lib/tunnel velocity/temperature, within this VI adjust the barometric pressure and the density of the liquid used in the Rouse manometer.
- Open VI: D:/IIHR.lib/IIHR.top/x-ducer.lib/Two-xducer calibration.
- Use 8 points for calibration taking the 20 full rotations and rotating every 4 turns, adjusting the multimeter in increments of 1 volt from -5 to +5 volts. When you hit the zero volt line remember to reverse the tubing into the Rouse manometer to account for the negative pressure readings.

Calibrating Validyne

4.1 Volts	0.618 inches of alcohol
3.1 Volts	0.464 inches of alcohol
2.0 Volts	0.305 inches of alcohol
1.0 Volts	0.154 inches of alcohol
(Reverse tubes into validyne)	
-1.05 Volts	-0.1745 inches of alcohol
-2.08 Volts	-0.3275 inches of alcohol
-3.08 Volts	-0.4770 inches of alcohol
-4.02 Volts	-0.6400 inches of alcohol