

AerE344 Pre-Lab Assignment - Experiment Design Component

Lab # 10: Pressure Measurements in a de Laval Nozzle

You will need to finish this pre-lab assignment before you come to the wind tunnel laboratory to do the experiments.

What you will be given for your experiment:

- A blown up supersonic wind tunnel
- A De Laval supersonic nozzle
- A schlieren flow visualization system
- A 16-channel digital pressure transducer unit for pressure measurements

What you need to know before you came to the lab:

- You should review and understand the concepts of shockwave, total-Static-Mach relationship.
- You should review and understand the concepts of quasi-1D Nozzle theory, de Laval nozzle.
- You should review and understand the concepts of supersonic flow from a de Laval nozzle, under-expanded flow, 3rd critical condition, Over-expanded flow with oblique shocks, 2nd critical condition, normal shock existing inside the nozzle, and 1st critical condition.
- You should review and understand the concepts of shlieren technique.

Questions that should be answered after this experiment:

- What can you say about the predicted pressures in comparison to the measured pressures?
- That is, does the theory under- or over-predict the wall pressure?
- Give some possible reasons for the differences.
- What might this mean for the prediction of other flow quantities such as Mach number, temperature, etc.?
- Point out any interesting anomalies you might see in the measured data.