Fluids and thermal laboratory

EGME 306B – Spring 2022
Data reduction worksheet No. 01, due on February 23, 2023

Guidelines

The raw data must be processed and presented in graphical form in order to answer the *Review questions*. The data processing and plot generations must be performed in MATLAB. The *m-file* will be submitted separately from the responses to the *Review questions*. Your plots, tables, and review question answers should be presented in the form of a technical memo.

Data reduction

Present all results in SI units.

1. Present the pressure distribution across the Venturi meter by plotting h *vs.* distance at every station for all 6 runs. Plot the corresponding theoretical pressure distribution and compare.

2. Calculate the discharge coefficient C_d and Reynolds number Re at the throat for each run. The Reynolds number at the throat is given by

$$Re = \frac{\rho \overline{V} D_D}{\mu} = \frac{4\rho Q_{\text{act}}}{\pi \mu D_D}$$

   Plot the discharge coefficient against the Reynolds number and fit the data with a 3^{rd} order polynomial function. *i.e.*,

$$f(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3$$

   Compile your results in a table that follows the format of Table 1.

Table 1: *Format for table of results relating to Re vs.* C_d

Run	$h_A - h_D$ (m)	Q_{act} (m^3/s)	Q_{theo} (m^3/s)	C_d	Re
1					
2					
3					
4					
5					
6					

3. Calculate total head loss h_T (in meters) from inlet to outlet for each run. Plot head loss against volumetric flow-rate and fit data with a 2^{nd} order polynomial function, *i.e.*,

$$f(x) = a_0 + a_1 x + a_2 x^2$$

   Plot the function and comment on the results.

Data reduction

Address the following questions. Use the results, *i.e.,* refer to figures, from the *Data Reduction* to support your analysis.

1. How many pressure taps do you need to use in order to use a Venturi as a flow measuring device? Where should these taps be located?

2. Which section of the Venturi does the measured pressure deviate most from the theoretical prediction?

3. Explain what may be causing the discrepancies between experiment and theory.

4. How would you change (or redesign) the Venturi to get a better pressure recovery?

5. What is the effect of Reynolds number on the discharge coefficient?

6. How does increasing the Reynolds number of the Venturi flow affect the pressure distributions between the actual and theoretical results?