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MET 330

Test 2 Reflection

11/4/2021

Test #2 Reflection

1)

This test touched on a lot of the course objectives that we have for this class because it was working with an entire piping system and a pump that was supplying water to a heat exchanger. A few of the biggest objectives that were assessed on this test were applying Bernoulli's equation, Computing friction losses in pipes for a variety of configurations (series, and parallel in this case), and explaining the fluid dynamics in pipes. The first two were the bulk of the problem in this test where the entire system had frictions losses and energy losses throughout with different elbows, valves, fittings, and different size pipes that we needed to find the friction losses in. To do this we had to apply Bernoulli's equation in order to find the power that the pump would need to overcome all of the losses that the system would see. Once we found the power that the pump would need to deliver the correct amount of water we could find the size of the motor that would be required to run the pump. In part 2 of the problem we were faced with a parallel system where we needed to do iterations to find the friction factors inside of the different sized pipes in order to calculate the K value of the valve in the one inch pipe at different degrees of being open. Since this problem was an actual system that was supplying a heat exchanger with the amount of flow it needed it really touched on everything this class is about in designing the pump correctly for the system. It was nice to see how everything kind of came together at the end of the semester and really used all of the topics from the course in order to complete a problem that could be seen in real life.

2)

When talking about the first part of the problem I believe I did everything correctly and to a T. This problem was very in depth and had a very long equation that was used to solve it and I came out with the correct answer to the problem. In looking at the solution I did not solve for all my energy losses separate but threw them into the same Bernoulli's equation to solve. This made the equation much heavier to work but ended up giving me the correct calculation for the amount of power that the pump would need to run. I used $h_A = h_L + \Delta z$ in order the find the energy the pump would need to input into the fluid in order to have a flow rate of 275 gpm to the Heat Exchanger. I am very proud of how well I did on this section of the test and believe that I have a very good grasp on the information required to solve problems like this one in the future.

On part 2 of the test I did not have as much luck on knowing exactly how to solve it and how to go about getting the information I needed for it. I set up my Bernoulli's equation correctly for both sides of the parallel system but then I got confused by the fact that this problem needed to use iterations and K was the value that we needed to guess. I thought that the K value in this part was the part that we were iterating and we had to find the friction factor for the pipes elsewhere. I solved for the flow rate at the top of the riser and then used that flow rate in order to find the friction factor for the 1" pipe. I learned from the solution that the friction factor in the pipes was what we were supposed to be iterating and the rest of my solve does not match up to the solution. I believe I was somewhat on the right track and think that I did apply what I know to the problem at hand, but I wish I would have just watched and listened more in order to understand that when it is an iteration friction factor is what needs to be iterated. The answers that I received on my excel sheet were not far off from the answers that were supplied in the solution, but that could just be dumb luck from having friction factors that were close to what they were supposed to be. If I could redo this section of the test I am very confident that I could do it flawlessly like I did on part 1 of this test.

Writing Rubric:

1. Purpose: .5/10
    a. In this section I stated clearly what the objective of the problem and the given numbers for the problem.
2. Drawings: 1.0/10.0
    a. In this section I clearly draw out the system needed for the problem and label all measurements and needed values.
3. Sources: 1.0/10.0
    a. I clearly labeled all of the sources that I used for the test in this section.
4. Design Considerations: 1.0/10.0
    a. I used the correct considerations for my design in this section.
5. Data & Variables: 0.5/10.0
    a. I clearly stated all of the given variables and found variables in this section in an organized manner.
6. Procedure: 2.0/10.0
    a. I described the procedure that was needed to solve the problems in clear concise steps that can be easily followed.
7. Calculations: 2.0/10.0
    a. For the calculations I show the work neatly and in an organized manner.
8. Summary: 0.5/10.0
    a. I thoroughly describe the design of the system and the way in which it works according to the calculations.
9. Materials: 0.5/10.0
    a. I stated all of the different materials that were used in the solving of the problem.
10. Analysis: 1.0/10.0
    a. In my analysis I discuss my findings and how both systems work according to the problem at hand.

Total : 10/10

Pump Head:

a. Initial setup – labeling, reference, points: 1/5
b. Appropriate use of Bernoulli's to solve for h_A: 1/5
c. Compute all 11 energy losses: 1/5
d. Compute pump power: 1/5
e. Correct final results: 1/5

Total : 5/5

Total Flow Rate After Opening Valve:

a. Setting up the equations (2 eq from Bernoulli's): 2/7
b. Consider ALL energy losses in each branch: 1/7
c. Setting up the iteration process: 0/7
d. Solving the equations using excel: 1/7
e. Tried all valve opening cases: 1/7
f. Correct final results: 0/7

Total : 5/7

Overall Total: 10+(90/2)(5/5 + 5/7)= 87.143

While taking this test I was very confident on how to go about solving and solving part 1. Part 2 was a different scenario. I was stuck on how I was supposed to solve for different things in order to be able to punch the random K values into my equation. After seeing the solution for the test I am a little upset with myself that I could not get my brain to the point of iterating the friction factors. I think I managed my time well in completing this test. I worked on it over a few days and had some good nights sleep in between them so I could get a fresh pair of eyes on the problem the next day. I have learned how to apply what we have learned in class to real life scenarios and how to solve for what size motor is needed to run a pump that is supposed to be sending water at a specific flow rate. I think these concepts are used by engineers every day across many different types of engineering and for a countless number of applications. I do not believe in my current line of employment I will use anything that I learned for this test but I do think the way this problem made me think and troubleshoot will be used for the rest of my life in my engineering career. I have not been able to apply what I have learned to other courses but I do think I may have some coming up that this information will be very helpful to have and a great tool for me to be able to use. I feel like I am most improved in setting up Bernoulli's equation and being able to notice where all energy losses will come from and how they affect the system overall. Like I said I do not necessarily see this course intersecting with my career for the simple fact that I design mechanical systems for the corrugated industry and they do not involve much fluid mechanics. I spent a good bit of time on this test probably around 6 hours total across a few days, and I do believe that I spent an ample amount of time on this test in order to receive the grade that I believe I got on it. Overall I really enjoyed this test just because of how it applies directly to the industry and it really peaks my interest in a fluid mechanics career in the future.