MET330 Fluid Mechanics

Test 2 Reflection

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Course objectives

This test demonstrates the progress towards the course objectives of knowing how to describe fluid properties, calculating pressure and force, and identifying and solving specific industrial problems. The second test was about modifying and checking a design, rather than creating one. It focused on buoyancy and open channel flow, while still having pipe components that had to be calculated.

Comparison

In the test solution, all measurements were converted into metric. I decided to keep them in imperial because I am an American, but the answers look off at first glance. For the first question that asked to find the channel depth, I was close. I used the correct method on how to kind the channel depth, however I seem to have made a mathematical error. For one, I put 1.49 where just a 1 should have been over “n” and I am not sure why I did that. I used the equation $Q = \frac{1}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$ since I knew what “S” was and the values for A and R were in the book. I got a value of 1.625ft or 0.4953m, compared to the answer of 0.103m.

The second question wanted to know the force of the pipe and what was needed to support it. I knew this was statics analysis and started going at the problem like that. However, I ran into a problem since the book did not have density values for schedule 40 pipes, so without that I could not calculate the weight of the pipe and do a force across an area calculation. Then I reread the question and thought it was only asking for the forces on the elbow of the pipe. Therefore, I worked on that, however looking at the answers, the question did ask for the forces of the entire pipe. I started out with a similar approach, finding the velocity first, which I calculated to 13.618ft/s or 4.15m/s compared to the actual value, 3.6m/s. I am sure the rest is wrong seeing as I did a different kind of analysis, and the pound-force I calculated on the elbow was 428.302lb-f that calculated to 1903.84N, compared to the actual value of 445.94N.

The third section wanted to find the largest log that could fit in the open flow channel. I did not know what to do in the first place. The book was rather sparse on this subject and I combed through my notes trying to find if I had missed something. The information I found in the book all talked about three-dimensional problems when this seemed to be a simple two-dimensional problem, so I was just lost. The only thing I knew was that it would float, because the density of the wood was smaller than the density of water, and from experience, I know wood floats. At first, I thought that it had to be smaller than the channel, so I started by finding all the dimensions of the channel itself. I ended up putting the water force against the force of the wood and gravity, and found the weight of the wood. From there I just guessed a size of the wood board that would have that same weight.

The forth section was asking what the pressure drop across a flow nozzle would be. I began this by find the Reynolds number and find the coefficient, which I calculate to 0.732, which is not quite far from the actual value of 0.983. After I found C, I used the equation $Q = CA\sqrt{\frac{2g(P_1 - P_2)}{\left(\frac{A_1}{A_2}\right)^2 - 1}}$, though I seem to have lost the first area value in my calculation. I calculated the pressure drop to be 1006.209, which I did not even label with a unit, and was way off because the actual value was 101.11kpa.

The fifth section asked for the pressure increment after a sudden shut. I was once again lost on this section, because the book does not talk about water hammer. Despite this, I used the correct equation, incorrectly and got a very small number for the coefficient. Then I found the pressure, and a similar story played out, correct formula used incorrectly.

The sixth section wanted to find maximum drag force if the log was stuck. This section was more or less completely wrong because I could not figure out how to calculate the size of the log in the first place.

The last section wanted to find the force on the blind flange. I thought this was going to be simple, and I multiplied the density times gravity times the area of the flange times the weight of the water. I got 44.274lb-f, which equates to 196.940N, compared to the actual value, 460.53N. I also believed it was asking for general location of the force and not precise values, so I simply thought the force would be focused on the center. The first mistake I made was not using Bernoulli's equation and finding the pressure that the air was applying to the water.

There was supposed to be a summary and analysis of the entire test, but I did not notice that when I was focused on the actual test. Going by the rubric on the test, here is how I think I did:

	Score	Percentage
Purpose	10	5%
Drawings	7	10%
Sources	10	5%
Design Considerations	4	10%
Data/ Variables	10	5%
Procedure	7	25%
Calculations	4	20%
Summary	0	5%
Materials	10	5%
Analysis	0	10%

So putting all my scores together, I believe I got close to a 56.5

Discussion

I feel better about this test, despite still getting a low score, because I was on the right track for a decent portion of the test. Unlike test 1, where I really had no Idea what I was doing. I am upset at myself for not looking at the rubric and doing a summary and analysis, as those were easy point and could have really boosted my grade. If I had done them, I actually could have gotten at 71.5 or close to it. Still, it was an improvement over the first test. I feel like I have learned more about the practical applications and how to better manipulate the equations. I also feel more confident, seeing as I have improved compared to last test. I can imagine how open channel flow has been used by engineers, as shipping lanes like the Suez and Panama canals are open flow channels.