Carter Fishback 23-09-2019

MET 440: Test 1 Reflection

1.) Learning Objectives Covered

The primary learning objective covered for this test was the behavior and origins of the convection coefficients, h. These values have always been provided on each of the tests for convenience. Test 4 described that this is not the case as the h coefficients are often gathered through experimental tests and mathematical iterations.

2.) Test Comparison (Lessons Learned)

Three glaring errors stand out to me the most as the primary source of error for my calculations; convection coefficients for the trapped air and infinite air, as well as, the temperature at the absorber plate.

When using the conservation of energy equation, I did not use the Q absorbed as my total. I used the total heat flux before it was incident on the absorber plate. This automatically caused an increase in my values for all further calculations. The Q absorbed was supposed to be used because the Q reflected is not useful for energy generation.

When calculating the film temperature close to the outside wall, I did not take the bulk temperature as outlined. Instead, I used an equation from the book that was for horizontal plates exposed to constant heat flux. I understand now the purpose of doing it as the solutions suggest is that the average temperature of the air close to the surface is calculated. I did use all other equations to compute Gr, Pr, and other properties of air correctly.

The trapped air was also a source of error in my final answer. I did not compute the temperature as both walls. One wall is the absorber plate while the other is at the bottom surface of the glass. Using the Q reflected or Q of the solar flux, the temperature of the air would have been able to be approximated. The temperature of the air would subsequently lead to the convection coefficient following that all other steps or properties of air were calculated correctly.

The temperature of the absorber plate was guessed for and iterated for, to simulate the answers to the first test. Since the temperature of the plate was found to be quite higher than the water in my solutions, it resulted in larger heat transfer quantities.

Though incorrect, my calculated h value for the water in the pipe was very close to the solutions. My procedure was correct, but, due to other wrong coefficients and plate temperature, my answer was slightly off.

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3.) Estimated Grade

Writing		Problem 1		
Purpose (0.5/10.0)	0.5	1. Thermal circuit	1/15 of 1/15	1
Drawings (1.0/10.0)	1	2. Evaluate individual resistances	1/15 of 1/15	1
Sources (0.5/10.0)	0.5	3. Conservation of energy equation	1/15 of 1/15	1
Design considerations (1.0/10.0)	1	4. Solving for absorber temperature	1/15 of 1/15	1
Data and variables (0.5/10.0)	0.5	5. Q to water, mass flow rate, efficiency	1/15 of 1/15	0.5
Procedure (2.5/10.0)	1.9	6. Iteration process (assume hs and so on)	3/15 of 3/15	3
Calculations (2.0/10.0)	2	7. Pick right equation for outside air	1/15 of 1/15	0.5
Summary (0.5/10.0)	0.5	8. Outside air properties read at right temp	1/15 of 1/15	0.5
Materials (0.5/10.0)	0.5	9. Pick right equation for inside air	1/15 of 1/15	0.8
Analysis (1.0/10.0)	1	10. Inside air properties read at right temp	1/15 of 1/15	1
		11. Pick right equation for water	1/15 of 1/15	0.5
Total Points (x/10.0)	9.4	12. Water properties read at right temp	1/15 of 1/15	1
Total Test Points	61.20666667	13. Final result	1/15 of 1/15	0.5
Total Grade (Before HW Addition)	68.0%	Total Points		11.3

4.) Final Thoughts

The main issue that I ran into on this test was selecting and implementing the correct formula from the book into the problem. With three convection coefficients, there are three similar, yet different solution sets that require different properties to solve. It was extremely beneficial that I created a detailed procedure as to how to solve the problem to assist in the creation of my excel iteration document.

Convection coefficients are rarely given in a practical situation. These values are found through many different types of experiments and can vary from situation to situation. This justifies why engineers must be taught how to find these values. Once found, they will serve as a staple in the design, installation, and maintenance of any system with different types of convection inducing fluids.

After completing I have a better understanding of how convection coefficients can be calculated and then used in a system. This test also solidified my ability to develop a detailed procedure and implement it into a data base program (Excel) to iterate for temperamental values of h. By completing the same problem as the first test, but without the h coefficients, it demonstrated that these complex problems have multiples ways of solving them and determining a real solution.