Carter Fishback 23-09-2019

MET 440: Test 1 Reflection

1.) Learning Objectives Covered

Test 1 focused on the concept of one-dimensional heat transfer. All problems were considered steady state and did not contain any heat generation. The first problem primarily focused on the application of conduction and convection of heat through various materials or fluids. These modes of heat transfer were implemented through the problem with the drawing of different types of materials with unique conduction and convection coefficients. To analyze the transfer of heat through the system, the use of the thermal circuit concept, another course learning objective. Similar to an electrical circuit, the thermal circuit served as a map of how the heat would flow through each material. Convection and conduction between materials can be decided and mathematically applied to the circuit to calculate the total heat transfer or temperature differences in materials.

Problem 2 was simpler in that the primary concept being evaluated was heat transfer through a fin. This did test the concepts previously mentioned that were seen in problem 1, however, it focused on the different cases and equations regarding heat transfer through a fin. This served as another mode of heat transfer that differed from specific planes and shapes. A thermal circuit was still needed to find the flow of heat transfer through the copper alloy.

2.) Test Comparison (Lessons Learned)

Problem 1:

Procedurally, I missed three key steps that were over thought.

(1) I did not calculate the Q absorbed and used as the total heat transfer in through the system of the 1 m x 0.0254 m.

(2) I did not find Q1 and Q2 of the system and directions they flowed to find the temperature absorbed at the absorber plate. In the thermal circuit, I needed to identify that there was heat transfer happening through the absorber plate and to the water, as well as, heat being reflected in the opposite direction through the air space and glass.

(3) I did not use the conservation of energy equation to sum together each of the Q values to find the amount of energy that the water absorbed in watts.

The Q2 value that would have been calculated would have been used to determine the temperature in the air space of the panel, mass flow rate of the water, and thermal efficiency of the entire system. Mathematically, my process was what was needed to determine the answers to the prompts, but, because of the three missed procedure steps, I did not find the correct answers. I did not take into account the heat that was also being reflected at the absorber plate in the "negative" direction.

Carter Fishback 23-09-2019

MET 440: Test 1 Reflection

Problem 2:

My primary source of error for this problem was assuming the wrong case and, subsequently, obtaining used the wrong equation. The problem stated that the heat at the tip of the rod was a different temperature than 1 ft away. When looking for an equation, I assumed that because the tip was also exposed to the ambient air that convection would occur. With that in mind, I decided to use case A, equation 2.

3. Estimated Grade

Writing		Problem 1		Problem 2	
Purpose (0.5/10.0)	0.5	8 Resistances (1/14)	1	Justification to Pick T Eq. (1/6)	0.5
Drawings (1.0/10.0)	1	Q from Sun to correct node (1/14)	0	A=? P=? (1/6)	1
Sources (0.5/10.0)	0.5	Conservation of energy quation (1/14)	0.2	m as a function of k (1/6)	0.8
Design considerations (1.0/10.0)	1	Correct Areas in Convection Resistances (1/14)	1	Solving for k (2/6)	1.8
Data and variables (0.5/10.0)	0.5	Shape Factor (1/14)	1	Final Results (1/6)	0.75
Procedure (2.5/10.0)	1.5	Glass and Tube Resistance (1/14)	1		
Calculations (2.0/10.0)	1	Absorber Resistance Negligible (1/14)	0.8		
Summary (0.5/10.0)	0.4	Solving for Absorber Temp (2/14)	0		
Materials (0.5/10.0)	0.5	Q to Water (1/14)	0.5		
Analysis (1.0/10.0)	1	Temp of Air Space (1/14)	0.5		
		Water mass flow rate (1/14)	0.5		
Total Points (x/10.0)	0.79	Collector efficiency (1/14)	0.5		
Total Test Points	57.57261905	Final Result (1/14)	0.5		
Total Grade (Before HW Addition)	0.639695767	Total Points	0.535714286	Total Points	0.8083333

4. Final Thoughts

This test has taught me the importance of assuming all situations that could be present in a problem. For example, had I taken into account the Q reflected by the absorbing plate and back through the air and glass, I would have been able to use the conservation of energy equation to find the answers to each of the problems. It was the rigid problem-solving skills that contributed to me missing that crucial detail.

Engineers must consider heat transfer in a majority of situations. Engines, HVAC, and energy producing systems all have heat as a common bi-product that must be implemented into their calculations. When considering engine or piston cylinder designs, the heat from combustion must be considered to select the materials that can withstand such temperatures. Heating and air conditioning units must factor heat transfer in when considering the interaction between the ambient air and fluid that is taking on the heat to raise or lower the temperature. Energy producing systems, such as turbines, lose some of their efficiency due to heat loss in the system. Heat transfer is in every aspect of an engineer’s career and should be taken very seriously as is can cause complications if not properly handled.

I feel more comfortable in understanding the basic flow of heat transfer through multiple planes of materials. By seeing the mistakes that I made on this test, I understand how to approach similar problems and draw the thermal circuits accordingly. I know for sure that I will use this in my future career as an engineer no matter the industry.