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Week 5
Intention
Goal: What do you want to achieve at the end of Week 5? To get a better understanding on heat transfer with a more in-depth explanation on specific scenarios compared to vague concepts.
Desired Outcomes—learning outcomes I want to achieve in MECH 3228
Discuss the topics that seemed most interesting to you and where you anticipate you will use them. Understanding the application of fins and the effectiveness/reasoning of their use.
Self-Understanding—strengths that I can build on and development needs I can address to be successful in MECH 3228
Strengths: My strengths are notetaking and concentrating in class, which will both be very helpful when studying later for tests/assignments. Development Needs: Time management outside of class and organizing it so everything is studied as need be.

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LECTURE CONTENT
Describe the two ways to increase the heat transfer rate by convection. Increasing the heat transfer coefficient and the surface area of the fins.
Write down the general solution to the fin equation. What is θ defined as? $\frac{d^2\theta}{dx^2} - m^2\theta = 0$ where $\theta = T - T_\infty$ $\theta(x) = C_1 e^{mx} + C_2 e^{-mx}$
Write down the boundary conditions (BC) applied to solve the fin equation. Steady operating conditions because there are no changes in temperatures with time. The temperature along the fin varies in the 1D only perpendicular to the plate. The heat transfer coefficient is constant and uniform over the surface since the temperature of the air remains constant and uniform. Thermal conductivity remains constant over the temperature range. Heat transfer coefficient accounts for effect of radiation.
What is the condition to be able to apply the infinitely long fin BC? Fin tip approaches the ambient temperature. BC: $\theta(L \to \infty) = T(L) - T_\infty = 0$
Discuss the circumstances under which the adiabatic fin tip BC can be applied Negligible heat loss from the fin tip since the surface area of the fin tip is usually negligible fraction of the total fin area.
Discuss the convection at the fin tip BC and the practical way to account for heat loss. Convection at the tip will have the conduction vs convection plus the tip. Practical way is that heat loss from the fin tip is to replace the fin length L in relation for insulated tip case by corrected length defined as : $L_c = L + \frac{A_c}{P}$ $L_{c,rec} = L + \frac{t}{2}$; t = thickness $L_{c,cyl} = L + \frac{D}{4}$; D = diameter
Is the fin efficiency the same throughout the length of the fin? What is the efficiency of fins used in practice? At what efficiency the fins cannot be justified economically? Yes, the fin efficiency is the same throughout the length of the fin to make it easier to solve. Increasing the

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length of the fin beyond a certain value cannot be justified unless the added benefits outweigh the added cost. Fin lengths that cause the fin efficiency to drop below 60% usually cannot be justified economically. The efficiency of most fins used in practice is above 90%. $\eta_{fin} = \frac{\dot{Q}_{fin}}{\dot{Q}_{fin,max}}$
Write down the remarks regarding fin effectiveness and discuss the reasons they are true. Fins with triangular and parabolic profiles contain less material and are more efficient than the ones with rectangular profiles. The fin efficiency decreases with increasing fin length. Increasing the length of the fin beyond a certain value cannot be justified unless the added benefits outweigh the added cost.
Discuss the proper length of a fin. Compare the heat transfer from a fin of finite length to heat transfer from an infinitely long fin and see which offers a good compromise based on heat transfer performance for fin size.