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Week 8
Intention
Goal: What do you want to achieve at the end of Week 8? To get a between 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. To see the application of fluid mechanics in Heat transfer and show how closely related these topics are with all the scenarios and ways to approach questions.
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
In internal forced convection, what is the average temperature a function of? The energy transported by the fluid through a cross section in actual flow must be equal to the energy that would be transported through the same cross section if the fluid were at a constant temperature Tm.
What is the thermal entrance region? The thickness of this boundary layer increases in the flow direction until the boundary layer reaches the tube center.
What is the thermally fully developed region? The region beyond the thermal entrance region in which the dimensionless temperature profile expressed as $(T_s-T)/(T_s-T_m)$
Where is the friction factor and heat transfer coefficient the highest in internal forced convection? Where is the Nusselt number the highest? Why? The friction factor and heat transfer coefficient the highest in internal convection is at the hydraulic length and before the entrance region at the velocity boundary layer. The Nusselt numbers are much higher in the entrance region. The Nusselt number reaches a constant value at less than 10 diameters.
There are two different boundary conditions in internal forced convection. Define the two boundary conditions and discuss the Nu along the length of the pipe. The Nusselt numbers for the uniform surface temperature and uniform surface heat flux conditions are identical in the fully developed regions and nearly identical in the entrance regions.
How can the two boundary conditions be realized? Can both boundary conditions be realized at the same time? The Nusselt number is insensitive to the type of the thermal boundary.
When applying the constant heat flux boundary condition, how are the surface temperature and mean temperature being affected? In the fully developed region, the surface temperature will also increase linearly in the flow direction.
When applying the constant surface temperature condition, how does the mean temperature change? The mean temperature of the fluid increases in the flow direction the heat flux decays with x. $\frac{d\left(T_s-T_m\right)}{T_s-T_m}=-\frac{hp}{\dot{m}c_p}dx$
What is the logarithmic mean temperature? Comparison of the surface, exit, inlet temperatures and is prone to errors and this will give the mean temperature.

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$$\Delta T_{\ln} = \frac{T_i - T_e}{\ln[(T_s - T_e)/(T_s - T_i)]} = \frac{\Delta T_e - \Delta T_i}{\ln(\Delta T_e / \Delta T_i)}$$

What are the number of transfer units?

Large NTU value is the increasing tube length marginally increases heat transfer rate. The small NTU valye is the heat transfer increases significantly with increasing tube length.