Heat Transfer Questions & Answers

Question by Student 201327132

Dear professor. I have a question about assignment 6 #1. I found $Re_L = 1.42 \times 10^7$ *. But there is no information about* $Re_L = 1.42 \times 10^7$ *in Flow over Flat plate table. I confuse what I choose Nusselt num equation.*

Choose the correlation with the closest Reynolds number range. As long as the Reynolds number is close to the allowed range, this will yield minimal error. If the Reynolds number is far from the allowed range (5-10 times difference or so), then you should list in the assumptions that you had to make the assumption that a given Nusselt number correlation remains valid well beyond its indicated Reynolds number range. 1 point bonus.

Question by Student 201427103

I'm sorry. Let me write the second question on this post.

The second question. Here's a question about Eckert Number. I can interpret the physical meaning of Eckert Number as the ratio of kinetic energy to heat energy. That is, a large flow of Eckert Number can be interpreted as a noticeable increase in temperature when kinetic energy is converted into thermal energy.

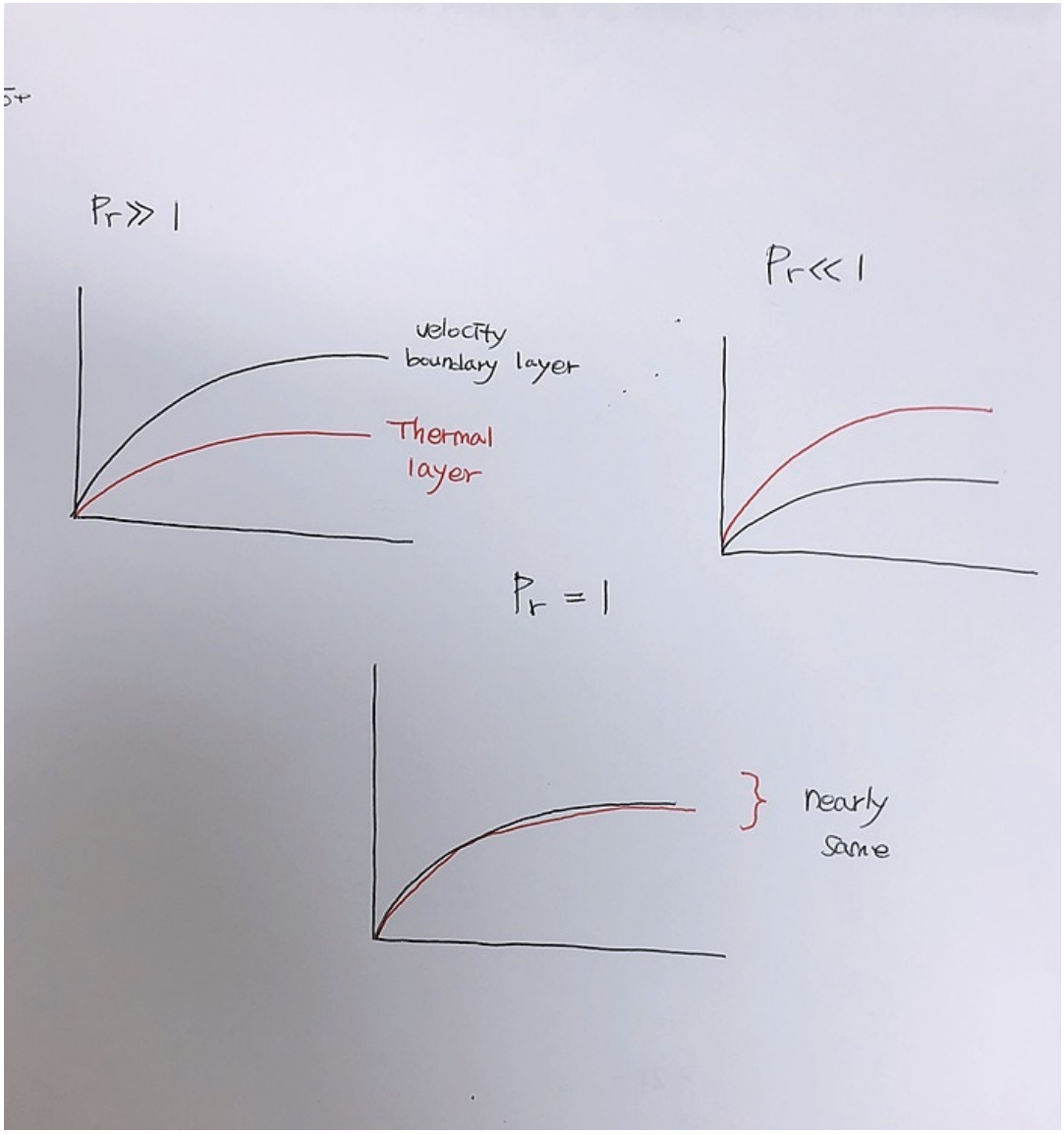
So here I have a question : Let's assume Eckert Number is very high. That is, Assuming that liquidity is supersonic , friction generates enormous heat. There are two shapes in this fluid field : one is sharp and the other is blunt. The two features are already experimental proof that they cause different aerodynamic heating. (due to shock)

So can I think of a different Eckert Number on both figures?

Hmm, this is well beyond the scope of this course and may confuse others (especially those who haven't taken the course compressible flow yet). I am not sure if the Eckert number is larger or lower within the boundary layer over a blunt body or cone.. You need to find the flow properties after the shock and compute the Eckert number using such properties..

Question by Student 201427103

Thank you for previous answer.
The other question is about Prandtl Number.
Is it true that i understand??



Yes, exactly. Indeed, recall the derivation of the Nusselt number:

$$\frac{\delta_t}{\delta} \propto \mathrm{Pr}^{-1/3}$$

Thus, the larger the Prandtl number, the smaller δ_t is compared to δ. 1 point bonus.

Question by Student 201527110

Professor, I have a question related with "High speed" flow correction.

I found that new film temperature T and adiabatic wall temperature* T_{aw} *can be derived from Isentropic relation*

$$\frac{T_0}{T_\infty} = 1 + \frac{\gamma - 1}{2} M_\infty^2$$

and relation of stagnation enthalpy

$$h_0 = h_\infty + \frac{u_\infty^2}{2} with \Delta h = c_p \Delta T$$

Your question is incomplete. Ask it again below. Before posting, check with preview first.

Question by Student 201527110

Sorry, I miss click the button. Using above equations and define new factor named as "Recovery factor" which can be defined as follow;

$$r = \frac{T_{aw} - T_\infty}{T_0 - T_\infty}$$

In here, I wonder the physical meaning of the recovery factor. Is that just a ratio between temperature differences?

I don't understand well your logic and how this recovery factor can be obtained from the stagnation temperature equation (you should have explained this fully). But anyway, you define r as the ratio between temperature differences, so this is one physical meaning of it — I don't see any other possible physical interpretation..

Question by Student 201427103

Dear Professor.
I am writing to ask you a question while solving Question # 5 in Assignment 7.
The condition given is Constant Heat Flux. So I referred to the given table.

According to this table, I see "Constant heat flux, local h " . So I did the same process as the attached picture to prove the assumption that h is also constant.

The results show satisfaction when the m is 1/4.
*However, if Gr * is greater than 10^5 and less than 10^11, then the last equation attached to the picture will not be formed.*
How do I interpret this?

Additionally, I am having difficulty solving this Question # 5 in Assingment 7. Do you have any suggestions for our?

Thank you.

KakaoTalk_20180609_155626471.jpg

You have to use LaTeX for the math. Use an attached figure only for a schematic. Also, avoid breaking lines. One question is one paragraph (one idea). Breaking lines makes it hard for me to read your question.