



Heat transfer II
Homework set 1

Course by Dr.Moosavi
Due date: 90/8/1

- 1) Consider laminar flow of a fluid over a flat plate maintained at a constant temperature. Now the free-stream velocity of the fluid is doubled. Determine the change in the drag force on the plate and rate of heat transfer between the fluid and the plate. Assume the flow to remain laminar.

- 2) Forced air at $T_\infty = 25^\circ \text{C}$ and $V = 10 \text{m/s}$ is used to cool electronic elements on a circuit board. One such element is a chip, 2mm by 2mm, and experiment showed that the heat transfer is correlated by an expression of the form $Nu_x = 0.1 Re_x^{0.8} Pr^{1/3}$. Estimate the surface temperature of the chip which is located 1.5m from the leading edge of the board if it is dissipating 20mW.

- 3) The local heat transfer coefficient h_x for flow over a flat plate with an extremely rough surface were found to fit the relation $h_x = ax^{-0.2}$ where a is a coefficient ($\text{W/m}^{1.8} \cdot \text{k}$) and $x(\text{m})$ is the distance from the leading edge of the plate. Develop an expression for the ratio of the average heat transfer for a plate of length x to the local heat transfer coefficient at x .