FDE 208 HEAT TRANSFER AND THERMAL PROCESSES

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CONVECTION

- For heat conduction and convection, there should be a temperature difference between two points and there also should be a medium.

- In case of convection, mostly the medium is in liquid form.
- Natural convection
- Forced convection

- Factor effective on convection;

-thermal conductivity of liquid

-density

-specific heat capacity

-dynamic viscosity

$$q_{cond} = -k_{akışkan} \cdot \left.\frac{dt}{dy}\right|_{y=0}$$

$$q_{conv} = q_{cond}$$

$$q_{conv} = h.(Ts - T\infty)$$

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$$h = \frac{-k_{akışkan} \left.\frac{dT}{dy}\right|_{y=0}}{Ts - T\infty}$$

DETERMINATION OF HEAT TRANSFER COEFFICIENT

- Flow over plain plates:

$$\begin{cases} Nu = \dfrac{h.L}{k} = 0,664.\mathrm{Re}_L^{1/2}.\mathrm{Pr}^{1/3} & \mathrm{Re} < 5*10^5 \ \text{oldugunda} \\ & \mathrm{Pr} \geq 0.6 \ \text{oldugunda} \\ Nu = \dfrac{h.L}{k} = 0,037.\mathrm{Re}_L^{4/5}.\mathrm{Pr}^{1/3} & 1*10^7 > \mathrm{Re} > 5*10^5 \ \text{oldugunda} \\ & 0.6 \leq \mathrm{Pr} \leq 60 \end{cases}$$

- Flow over cylinders or spheres;

$$Nu = \frac{h.D}{k} = 0.3 + \frac{0,62.\,\mathrm{Re}^{1/2}\,\mathrm{Pr}^{1/3}}{\left[1+\left(\frac{0.4}{\mathrm{Pr}}\right)^{2/3}\right]^{1/4}} . \left[1+\left(\frac{\mathrm{Re}}{28200}\right)^{5/8}\right]^{4/5}$$

- For spheres;

$$Nu = \frac{h.D}{k} = 2 + \left[0,4.\mathrm{Re}^{1/2} + 0,06\,\mathrm{Re}^{2/3}\right]\mathrm{Pr}^{0.4}\left(\frac{M\infty}{Ms}\right)^{1/4}$$

- For flow inside tubes;

$$Nu = 1,86\left(\frac{\mathrm{Re}.\mathrm{Pr}.D}{L}\right)^{1/3}.\left(\frac{Mb}{Ms}\right)^{0,14}$$

- In case of natural convection, Grashoff number should be calculated;

$$Gr = \frac{g.\beta.(T_S - T_\infty).\delta^3}{\nu^2}$$

- β: Expansion coefficient.
- v: Kinematic viscosity.
- g: gravity acceleration.
- δ: length