



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

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

$$q_{\text{conv}} = q_{\text{cond}}$$

$$q_{\text{conv}} = h \cdot (T_s - T_{\infty})$$

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

DETERMINATION OF HEAT TRANSFER COEFFICIENT

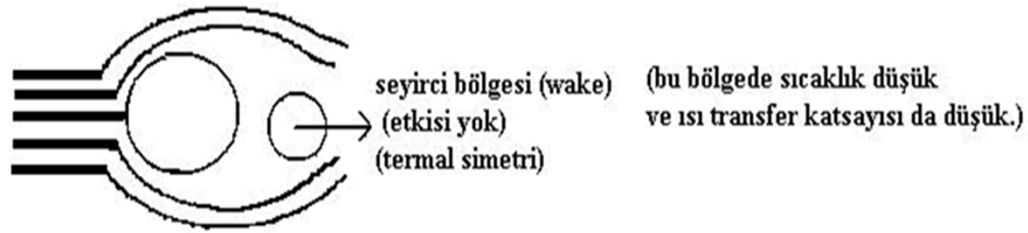
- Flow over plain plates:

$$\left\{ \begin{array}{l} Nu = \frac{h.L}{k} = 0,664 . Re_L^{1/2} . Pr^{1/3} \quad Re < 5 * 10^5 \text{ oldugunda} \\ \\ Nu = \frac{h.L}{k} = 0,037 . Re_L^{4/5} . Pr^{1/3} \quad 1 * 10^7 > Re > 5 * 10^5 \text{ oldugunda} \end{array} \right.$$

$Pr \geq 0.6$ oldugunda

$0.6 \leq Pr \leq 60$

- Flow over cylinders or spheres;



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

- For spheres;

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

- For flow inside tubes;

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

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

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

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