

SNS College of Technology



(An Autonomous Institution) 19ASE304/ Heat Transfer Unit -4/ Convective heat transfer, Stream function

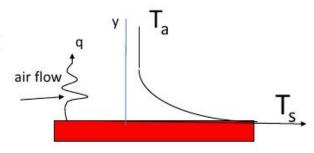
Convective Heat Transfer

Newton's Law of cooling

$$q'' = h_c(T_s - T_a)$$

$$q'' = \frac{(T_s - T_{a)}}{\frac{1}{h_C}}$$

$$R_c = \frac{1}{h_c}$$



where:

h c is convection coefficient (W/m2C), T_s is surface temperature (°C), T_a is surrounding air temperature (°C)

Rc= unit convective resistance.

Calculating the stream function

Given a velocity field:

$$\vec{V} = 2x \ \hat{i} - 2y \ \hat{j} \qquad u = 2x \qquad v = -2y$$

$$u=2x$$

$$v = -2y$$

Begin with u: $\frac{\partial \psi}{\partial u} \equiv u = 2x$

$$\frac{\partial \psi}{\partial y} \equiv u = 2x$$

$$\partial \psi = u \ \partial y = 2x \ \partial y$$
 $\psi = 2xy + f(x)$

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Continue with v: $\frac{\partial \psi}{\partial x} \equiv -v = 2y$

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$$\partial x$$

$$\partial \psi = -v \ \partial x = 2y \ \partial x$$
 $\psi = 2xy + f(y) + C$

Comparing the two expressions and choosing C=0: $\psi = 2xy$