



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

Department of Mechanical Engineering

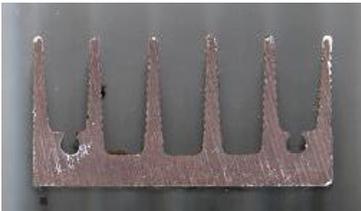
REPORT OF SKILL BASED MINI PROJECT

Heat and Mass Transfer (120513)

Title of Project: Fins or extended surfaces

Introduction: In this course we have learnt about analysis of a fin, types of fins, steady state heat flow equation, fin efficiency, fin effectiveness.

Description of Model



What is a fin?

Fins are surfaces that extend from an object to increase the rate of heat transfer to or from the environment by increasing convection.

Applications of a fin

Fins are most commonly used in heat exchanger devices such as radiator in cars, computer CPU heat sinks, and heat exchangers in power plants.

Pin efficiency: -

$$\eta_{\text{fin}} = \frac{Q_{\text{Actual}} \text{ (Actual heat transfer)}}{Q_{\text{max}} \text{ (Maximum heat transferred when the whole fin is at base temperature)}}$$

Heat transfer through a fin: -

- **CASE 01**
INFINITELY LONG FIN

Infinitely Long Fin ($T_{\text{fin tip}} = T$)

- For a sufficiently long fin the temperature at the fin tip approaches the ambient temperature

Boundary condition: $\theta(L \rightarrow \infty) = T(L) - T_\infty = 0$

- When $x \rightarrow \infty$ so does $e^{mx} \rightarrow \infty$

$$\Rightarrow C_1 = 0$$

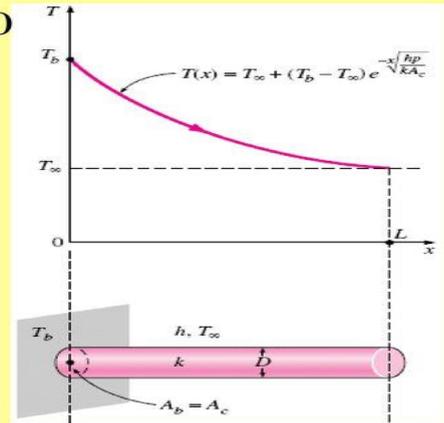
- @ $x=0$: $e^{mx}=1 \Rightarrow C_2 = \theta_b$

- The temperature distribution:

$$\frac{T(x) - T_\infty}{T_b - T_\infty} = e^{-mx} = e^{-x\sqrt{hp/kA_c}} \quad (3-60)$$

- heat transfer from the entire fin

$$\dot{Q} = -kA_c \left. \frac{dT}{dx} \right|_{x=0} = \sqrt{hpkA_c} (T_b - T_\infty) \quad (3-61)$$



• CASE 02

SHORT FIN WITH INSULATED TIP

Adiabatic Tip

- Boundary condition at fin tip:

$$\left. \frac{d\theta}{dx} \right|_{x=L} = 0 \quad (3-63)$$

- After some manipulations, the temperature distribution:

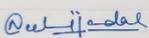
$$\frac{T(x) - T_\infty}{T_b - T_\infty} = \frac{\cosh m(L-x)}{\cosh mL} \quad (3-64)$$

- heat transfer from the entire fin

$$\dot{Q} = -kA_c \left. \frac{dT}{dx} \right|_{x=0} = \sqrt{hpkA_c} (T_b - T_\infty) \tanh mL \quad (3-65)$$

SUBMITTED BY:
NEELRAJ JAMDAR
0901ME201088

5th SEM MECHANICAL
ENGINEERING



SUBMITTED TO: -

DR. MANOJ KUMAR GAUR

(Head of the department)




Head
Deptt. of Mechanical Engineering
Machhav Institute of Tech. & Science
Gwalior - 05 (India)

