Ch 11.5 Cooling a Computer Chip

========================================================

author:

date:

autosize: true

Ch 11.5 Cooling a Computer Chip

========================================================

## Goals

- Consider heat fin problem

- Solve differential equation for analytical solution

- Use analytical solution to discuss general behavior of system

Problem Description

========================================================

- Heat is the bane of computer engineering:

- Electrical potential energy $\rightarrow$ Thermal energy (Heat)

- CPU heat build-up is especially troublesome because the chance for failure increases with temperature

- Heat fins and Heat sinks are used to drive thermal energy away from CPU

\*\*\*

<img src="./cpu\_heatfin.png" height=300px width=300px />

<img src="./cpu\_heatfin2.png"heigh=300px width=300px />

Cyrix 6x86 Chip Example

========================================================

- Let's look at the Cyrix 6x86 chipto find the equilibrium temperature:

- Generates heat at $q=24 \text{ Watts }$ ($\text{Watts} = \frac{\text{Joules}}{\text{sec}}$),

- Dimensions are $5.1 \text{ cm } \times 5.3 \text{ cm}$.

Newton's Law of Cooling:

$$

Q = hS \Delta U

$$

where $\Delta U$ is the temperature difference between the chip and the ambient temperature.

Cyrix 6x86 Chip Example

========================================================

$$

Q = hS \Delta U

$$

With

- $Q = 24 \text{ W}$,

- $h = 5 \frac{ \text{W} }{ \text{m}^2 \text{°C} }$ ,

- $S = 5.1 \text{ cm } \times 5.3 \text{ cm} = 2.7 \times 10^{-3} \text{ m}^2$,

we have that $\Delta U \approx 1,800$ °C.