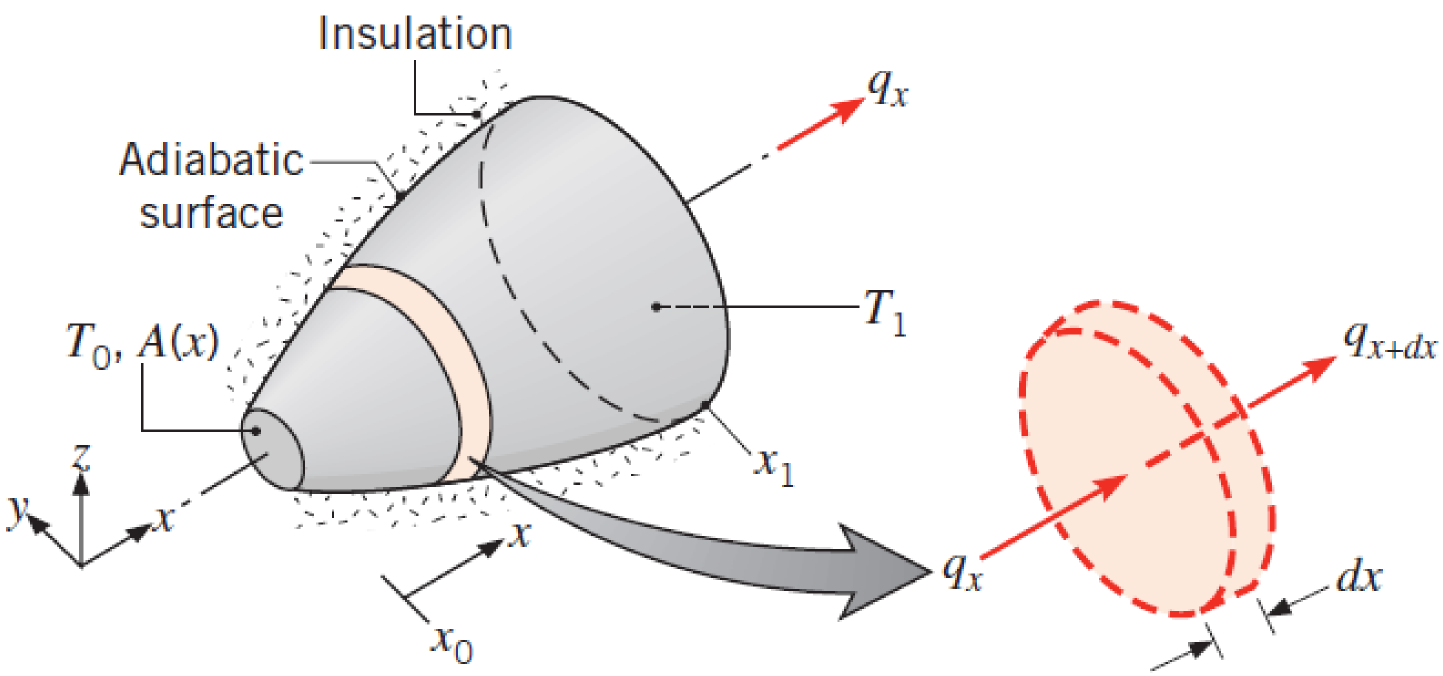
ALETAS

Alternativa para análise de transmissão de calor

- Regime permanente
- Sem geração de calor no VC
- Sem perdas pelas parede laterais
- qx é constante e independe de x



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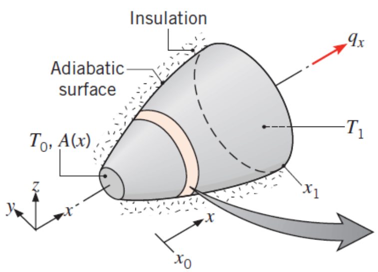
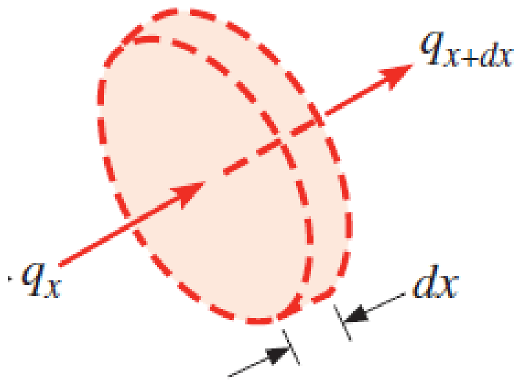
Alternativa para análise de transmissão de calor





Equação de Fourier

$$q_x = -KA\frac{dT}{dx}$$

Se $\quad q_x = -K(T)A(x)\dfrac{dT}{dx}$

$$\frac{q_x}{A(x)} = -K(T)\frac{dT}{dx}$$

se $dx \neq 0$
multiplicamos os dois lados por dx

$$\frac{q_x}{A(x)}dx = -K(T)dT$$

Integramos os dois lados

$$\int_{x_0}^{x}\frac{q_x}{A(x)}dx = \int_{T_0}^{T} -K(T)dT$$

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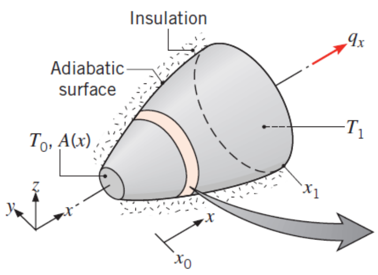
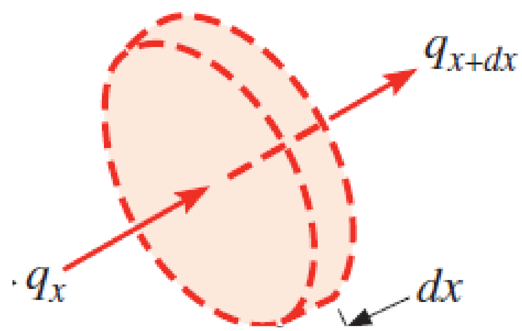




should be firmly fixed in our minds: *steady-state* and *one-dimensional* transfer with *no heat generation.*

$$\int_{x_0}^{x} \frac{q_x}{A(x)}\,dx = \int_{T_0}^{T} -K(T)\,dT$$

***T*= *T*$_0$ *quando x = x*$_o$**

Se ***A e K*** são constantes

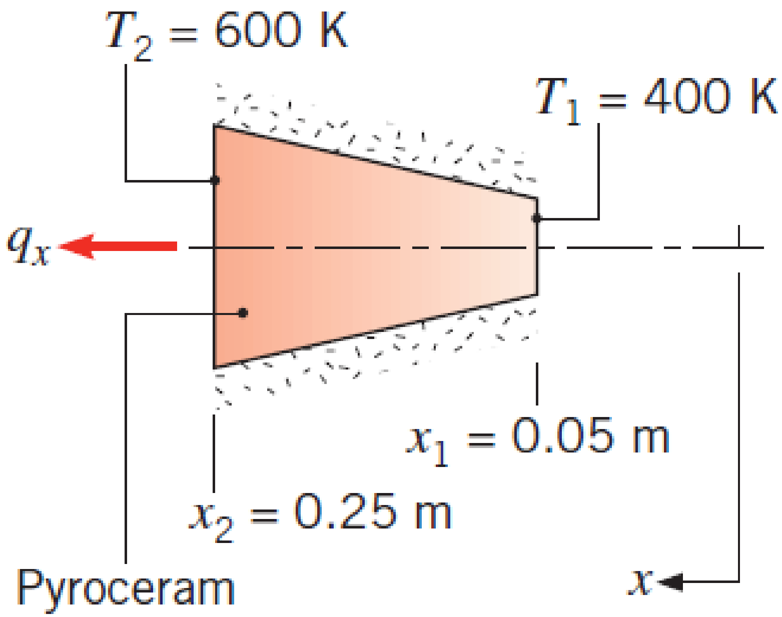
$$\frac{q_x\,\Delta x}{A} = -k\,\Delta T$$

Se e Somente Se => Regime permanente, unidimensional e sem geração de calor no VC.

ALETAS

Exemplo:

, pyroceram (500 K): $k = 3.46\ \text{W/m}\cdot\text{K}$.

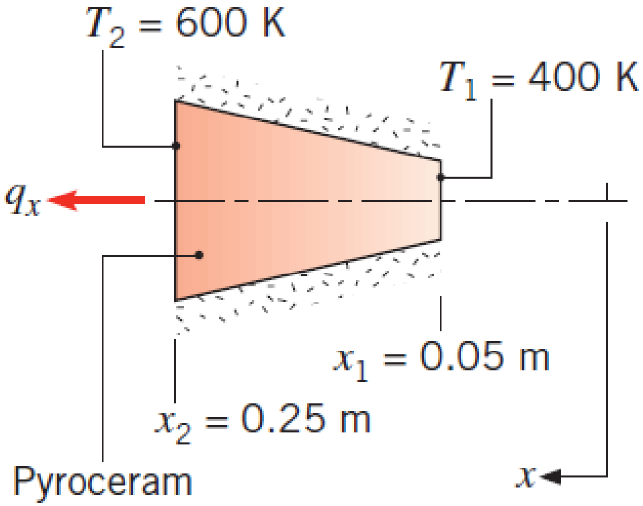


$$q_x = -kA\,\frac{dT}{dx}$$

ALETAS

Exemplo:

$$A = \pi D^2/4 = \pi a^2 x^2/4$$



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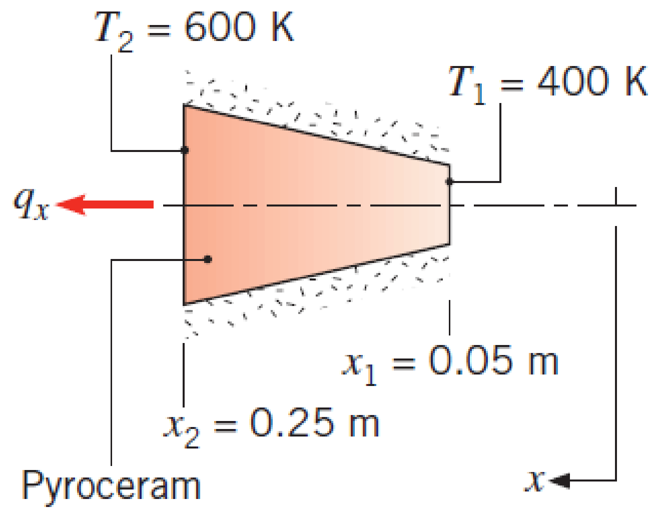
Exemplo:

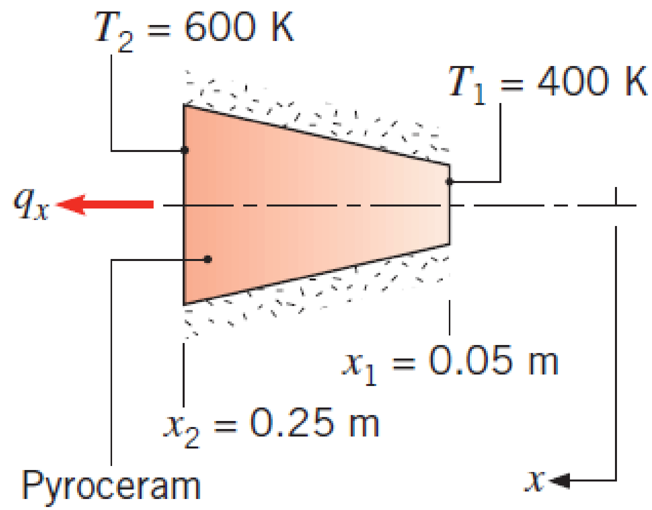
$$A = \pi D^2/4 = \pi a^2 x^2/4$$

$$\frac{4q_x dx}{\pi a^2 x^2} = -k dT$$



ALETAS

Exemplo:



$$A = \pi D^2/4 = \pi a^2 x^2/4$$

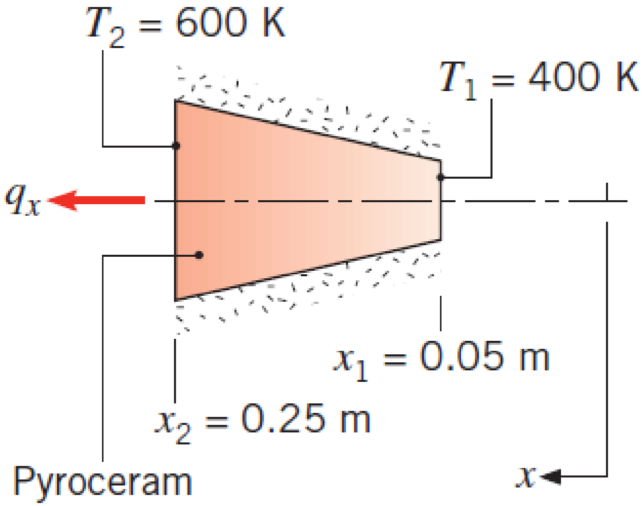
$$\frac{4q_x dx}{\pi a^2 x^2} = -k dT$$

$$\frac{4q_x}{\pi a^2}\int_{x_1}^{x}\frac{dx}{x^2} = -k\int_{T_1}^{T} dT$$

ALETAS

Exemplo:

$$\frac{4q_x}{\pi a^2}\int_{x_1}^{x}\frac{dx}{x^2} = -k\int_{T_1}^{T} dT$$



Integrando:

$$\frac{4q_x}{\pi a^2}\left(-\frac{1}{x} + \frac{1}{x_1}\right) = -k(T - T_1)$$

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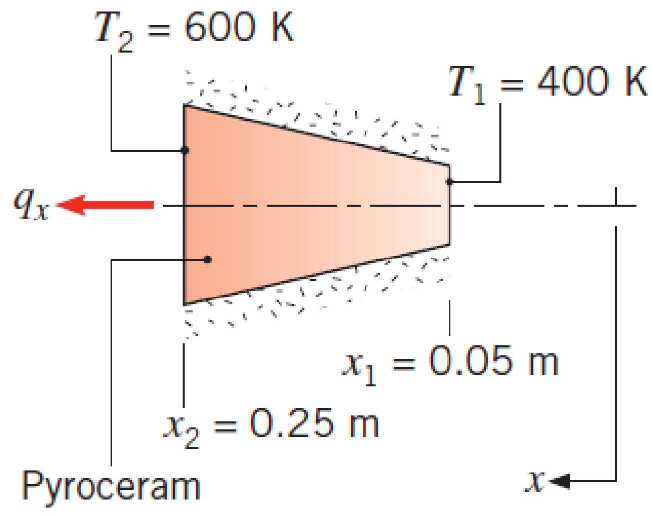
Exemplo:

$$\frac{4q_x}{\pi a^2}\int_{x_1}^{x}\frac{dx}{x^2} = -k\int_{T_1}^{T}dT$$



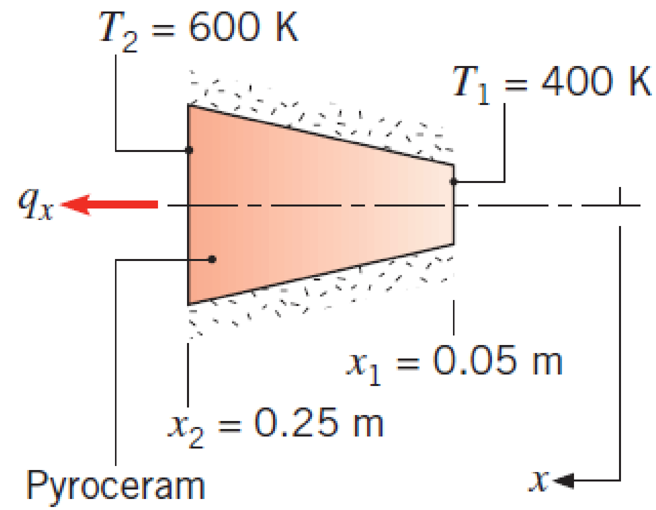
Integrando:

$$\frac{4q_x}{\pi a^2}\left(-\frac{1}{x}+\frac{1}{x_1}\right) = -k(T - T_1)$$

$$T(x) = T_1 - \frac{4q_x}{\pi a^2 k}\left(\frac{1}{x_1}-\frac{1}{x}\right)$$

ALETAS

Exemplo:



$$\frac{4q_x}{\pi a^2}\left(-\frac{1}{x}+\frac{1}{x_1}\right) = -k(T - T_1)$$

$x = x_2$, where $T(x_2) = T_2$.

$$T_2 = T_1 - \frac{4q_x}{\pi a^2 k}\left(\frac{1}{x_1}-\frac{1}{x_2}\right)$$

$$q_x = \frac{\pi a^2 k(T_1 - T_2)}{4[(1/x_1) - (1/x_2)]}$$

Substituindo $\boldsymbol{q_x}$ em $\boldsymbol{T(x)}$

$$T(x) = T_1 + (T_1 - T_2)\left[\frac{(1/x) - (1/x_1)}{(1/x_1) - (1/x_2)}\right]$$

$$T(x) = T_1 - \frac{4q_x}{\pi a^2 k}\left(\frac{1}{x_1}-\frac{1}{x}\right)$$

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Exemplo:

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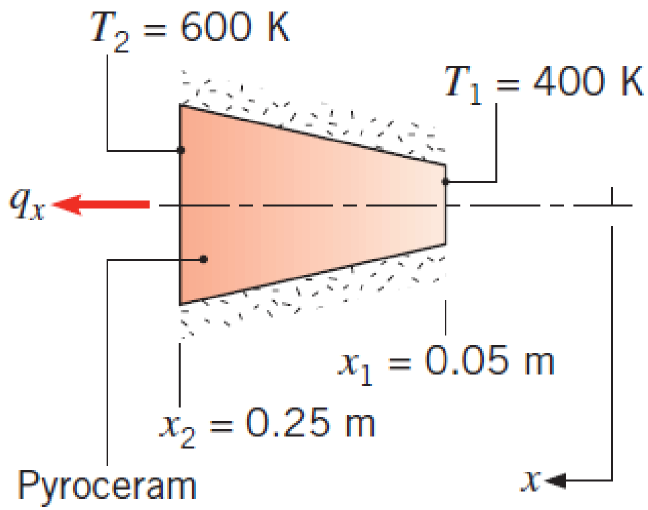

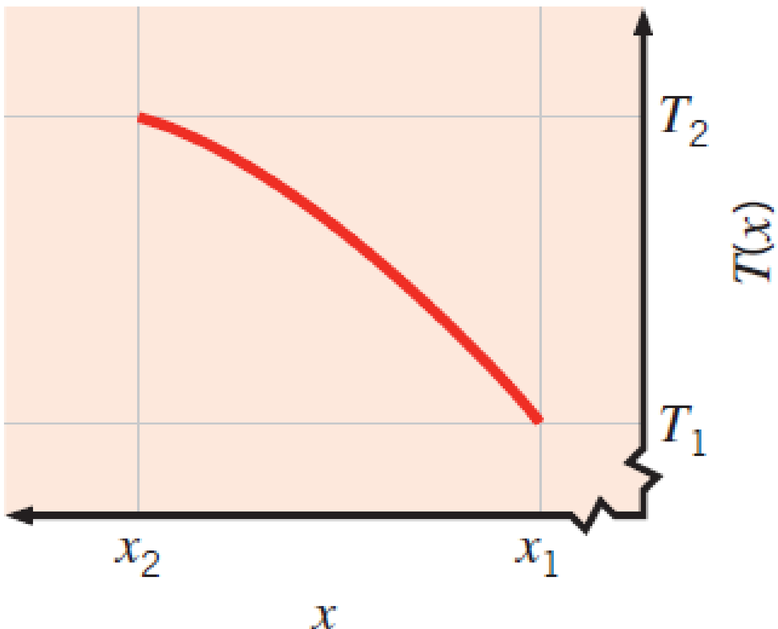

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Exemplo:

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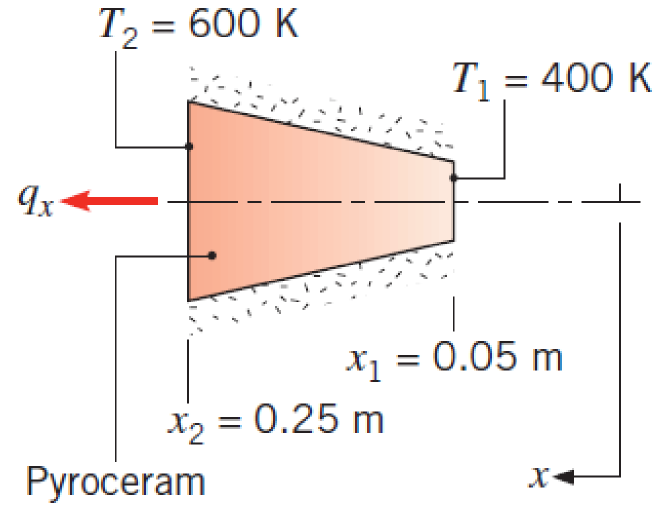

Substituindo valores numéricos:

$$q_x = \frac{\pi (0.25)^2 \times 3.46 \text{ W/m} \cdot \text{K} \,(400 - 600)\text{ K}}{4\,(1/0.05 \text{ m} - 1/0.25 \text{ m})} = -2.12 \text{ W}$$