$\frac{d}{dx}\left(AE\frac{du}{dx}\right)+10A_x=0$, $0<x<2$, $u(0)=10^{-4}$, $\vec{T}=10=E\frac{du}{dx}\Big|_{x=2}$

1. $\int_0^2 w\left[\frac{d}{dx}\left(AE\frac{du}{dx}\right)+10A_x\right]dx=0$, $\forall w(x)$

$\int_0^2 \left[w E\frac{du}{dx}\Big|_{x=2} - wA10\right]dx$

$= wA\left[E\frac{du}{dx}\right]\Big|_{x=2} - wA10 = 0$ $\forall w(2)$

2. IBP, $\int u\,dv = uv - \int v\,du$

$\int_0^2 w\frac{d}{dx}\left(AE\frac{du}{dx}\right)dx + \int_0^2 w\,10A_x\,dx$, $\frac{d(w(x))}{dx} = \frac{dw}{dx}$

$d(w(x)) = \frac{dw}{dx}dx$

$\int_0^2 \frac{d}{dx}AE\frac{du}{dx}\,d(w(x))$

$\frac{d(w(x))}{dw} = \frac{dw}{dx}$

$w(x)AE\frac{du}{dx}\Big|_0^2 - \int_0^2 AE\frac{du}{dx}\frac{dw}{dx}dx$, since $w(0)=0$

$d(w(x)) = \frac{dw}{dx}dx$

$w(2)AE\frac{du}{dx} - \int_0^2 AE\frac{du}{dx}\frac{dw}{dx}dx + \int_0^2 w\,10A_x dx$, since $E\frac{du}{dx}=\bar{t}$,

$w(2)AA10 - \int_0^2 AE\frac{du}{dx}\frac{dw}{dx}dx + \int_0^2 w10A_x dx = 0$

weak form