$$\int_D (\frac{\partial T}{\partial t} + \nabla \cdot T\vec{u} - \alpha \nabla^2 T - q)\omega_i \, \mathrm{d}x \, \mathrm{d}t = 0$$

$$\phi_i(t) = \begin{cases} 1 & t_{i-1} < t \leq t_i \end{cases}$$

$$\psi_i(x) = \begin{cases} 1 - \dfrac{x - x_{i-1}}{x_{i+1} - x_{i-1}} & x_{i-1} \leq x \leq x_i \\ \dfrac{x - x_{i-1}}{x_{i+1} - x_{i-1}} & x_i \leq x \leq x_{i+1} \end{cases}$$

$$\sigma_{i,k}(x,t) = \psi_i(x)\psi_k(t)$$

$$\lambda_{i,k}(x,t) = \psi_i(x)\phi_k(t)$$

$$\omega_{j,m} = \sigma_{j,m}$$

$$\int_D (\underbrace{\frac{\partial T}{\partial t} + \frac{\partial T\vec{u}}{\partial t}}_{T=\sigma_{i,k}T_{i,k}} + \underbrace{\frac{\partial T\vec{u}}{\partial x} + \frac{\partial^2 T}{\partial x^2}}_{T=\lambda_{i,k}T_{i,k}} + \underbrace{\frac{\partial^2 T}{\partial t^2}}_{T=\sigma_{i,k}T_{i,k}})\omega_{j,m} \, \mathrm{d}x \, \mathrm{d}t$$