Solve the Equation:

$$(EAu_x)_x + \bar{f}Ax = 0 \tag{1}$$

For initial conditions:

1. $u(0) = g_1$, $u(L) = g_2$
2. $u(0) = g_1$, $u_x(L) = \frac{h}{EA}$

For reference, the values are defined as:

$E = 10^{11}\ Pa$, $A = 10^{-4}\ m^2$, $f = 10^{-4}\ N$, $L = 0.1\ m$
$g_1 = 0\ m$, $g_2 = 0.001\ m$, $h = 10^6\ N$

Solution to initial condition (1):

$$u(x) = -\frac{\bar{f}}{6E}x^3 + \left(\frac{g_2 - g_1}{L} + \frac{\bar{f}L^2}{6E}\right)x + g_1 \tag{2}$$

Solution to initial condition (2):

$$u(x) = -\frac{\bar{f}}{6E}x^3 + \left(h + \frac{\bar{f}L^2}{2E}\right)x + g_1 \tag{3}$$

Lagrange Polynomial is used for the basis function in domain.

$$N^A(\xi) = \frac{\prod\limits_{\substack{B=1\\B\neq A}}^{N}(\xi - \xi_B)}{\prod\limits_{\substack{B=1\\B\neq A}}^{N}(\xi_A - \xi_B)} \tag{4}$$