

Computational Mechanics I - CIVL 537

Assignment 1

Due: Monday September 28, 2020

The governing differential equation for the equilibrium of a pre-stressed cable carrying a constant axial tension T and supported on an elastic foundation of constant modulus k (force per unit length per unit transverse deflection w) and subjected to a uniformly distributed transverse load of intensity p_0 per unit length, as shown in Figure 1, is given by

$$-T \frac{d^2 w}{dx^2} + kw = p_0; \quad 0 \leq x \leq L$$

Note that T , k , and p_0 are all constants.

Consider the following BC's:

$$\begin{aligned} w(0) &= 0 \\ w(L) &= 0 \end{aligned}$$

- For the case where $k = 0$, find a 2-term solution using the collocation method with the following trigonometric functions: $\sin\left(\frac{n\pi x}{L}\right)$, where n is an integer. Investigate the effect of choosing points that are symmetric (or not) with respect to the mid-span (centre-line) of the cable.
- For the case where $k = 0$, find a 2-term solution using the sub-domain method with the same trigonometric functions as in part (a). Select your intervals from $\left[0, \frac{L}{4}\right]$ and $\left[\frac{L}{4}, \frac{L}{2}\right]$. Investigate the effect of n .
- For the case where $k \neq 0$, setup a 2-term solution using the least squares method. Use **polynomial** functions as trial functions and only formulate your solution without performing the integration steps.
- For the case where $k \neq 0$, find a 1-term solution using the Galerkin method with a suitable trial function of your choice.

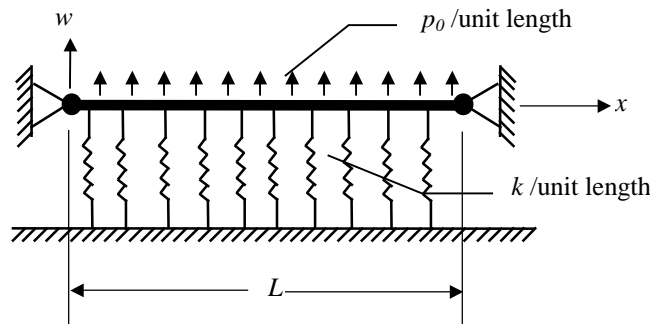


Figure 1