The sag-tension problem

Carlos Kleber c. Arruda

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Abstract

Just sketching the problem in some pretty equations...

1 Model

Premises:

Span depth ratio $> 1/8$, or inclined supports: the exact solution must be used

Span depth ratio $< 1/8$ and aligned supports: parabolic approximation can be used

Approaches

* Stationary * Eigenfrequency (Vibration) * Time dependent

Equação do cabo para vão nivelado

$$\frac{\partial}{\partial s}\left(T\frac{dx}{ds}\right) = 0 \tag{1}$$

$$\frac{\partial}{\partial s}\left(T\frac{dy}{ds}\right) = -mg \tag{2}$$

Para pequenas flechas, aproxima-se pela parábola

$$y = \frac{mgl^2}{2H}\left[\frac{x}{l} - \left(\frac{x}{l}\right)^2\right] \tag{3}$$

$$\frac{\partial}{\partial s}\left[(T+\tau)\left(\frac{dx}{ds} + \frac{\partial u}{\partial s}\right)\right] = \rho A\frac{\partial^2 u}{\partial t^2} \tag{4}$$

$$\frac{\partial}{\partial s}\left[(T+\tau)\left(\frac{dy}{ds} + \frac{\partial v}{\partial s}\right)\right] = \rho A\frac{\partial^2 v}{\partial t^2} - \rho A g \tag{5}$$

$$\frac{\partial}{\partial s}\left[(T+\tau)\frac{\partial w}{\partial s}\right] = \rho A\frac{\partial^2 w}{\partial t^2} \tag{6}$$

$$\ddot{q} + \mu\dot{q} + q + c_2 q^2 + c_3 q^3 = f(t) \tag{7}$$

Sendo q a coordenada modal, f o vetor arbitrário de força externa,

Reduced order model (ROM).