



D: E, A, S, l

u: effect. rovnice

• vln. hoary Euler

$$\begin{aligned} & \text{Free body diagram of a differential element of width } dx \text{ at position } x. \\ & \text{Left force: } F, \text{ right force: } F^*. \\ & \text{Reaction force: } -F + F^*. \\ & \text{Equilibrium equation: } \frac{M \cdot a}{A \cdot S \cdot dx} \frac{\partial \xi}{\partial t^2} = -F + F^*. \\ & F^* = F + \frac{\partial F}{\partial x} dx \end{aligned}$$

$$\frac{M}{T} = E \cdot \varepsilon = \frac{F}{A} \Rightarrow \frac{F}{T} = E \cdot A \cdot \varepsilon = E \cdot A \cdot \frac{\partial \xi}{\partial x}$$

$$AS \cdot dx \frac{\partial \xi}{\partial t^2} = F + F + E \cdot A \frac{\partial \xi}{\partial x^2} dx \quad F = E \cdot A \frac{\partial \xi}{\partial x}$$

$$\frac{\partial F}{\partial x} = E \cdot A \frac{\partial^2 \xi}{\partial x^2}$$

$$\frac{\partial^2 \xi}{\partial t^2} = \frac{E}{g} \frac{\partial^2 \xi}{\partial x^2}$$

vlivové rovnice
pro $\xi = \xi(x, t)$

$$\begin{aligned} y &= \sin \Omega t \\ \ddot{y} &= -\Omega^2 \sin \Omega t \\ \ddot{y} &= -\Omega^2 y \end{aligned}$$

Metoda separace f.c. $\xi = X(x) T(t)$

$$\frac{\partial^2 \xi}{\partial t^2} = X(x) \ddot{T}(t)$$

$$\frac{\partial^2 \xi}{\partial x^2} = X''(x) T(t)$$

$$\left. \begin{aligned} X \ddot{T} &= \begin{pmatrix} E \\ S \end{pmatrix} X'' T \\ \frac{\ddot{T}}{T} &= -C_0^2 \frac{X''}{X} = C_0^2 \end{aligned} \right\} \begin{array}{l} \text{1. rovnice} \\ \text{2. rovnice} \end{array}$$

1. rovnice

Logické dle ře

$$\frac{\partial^2}{\partial t^2} T + \frac{Q_0^2}{L^2} T = 0 \rightarrow T(t) = A \cos Q_0 t + B \sin Q_0 t$$

$$X'' + \frac{Q_0^2}{L^2} X = 0 \rightarrow X(x) = C \cos dx + D \sin dx$$

A, B → 2 poč. podmínek

C, D → 2 obrajoucí podmínek

$$\left. \begin{array}{l} \xi(0, t) = X(0)T(t) = 0 \\ \xi(L, t) = X(L)T(t) = 0 \end{array} \right\} \quad \begin{array}{l} 0 = C \cos d \cdot 0 + D \sin d \cdot 0 \\ 0 = C \cos d \cdot L + D \sin d \cdot L \end{array}$$

$$\left. \begin{array}{l} 0 = C \cos d \cdot 0 + D \sin d \cdot 0 \\ 0 = C \cos d \cdot L + D \sin d \cdot L \end{array} \right\} \quad \begin{array}{l} 0 = C \cos d \cdot L + D \sin d \cdot L \\ \Rightarrow C = 0 \end{array}$$

$$\begin{bmatrix} \cos d & \sin d \\ \cos dL & \sin dL \end{bmatrix} \begin{bmatrix} C \\ D \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \rightarrow 1 \cdot C + dD = 0 \rightarrow C = 0$$

Reseni det [] = 0



$$1. \sin d \cdot L - d = 0 \Rightarrow \sin d \cdot L = 0 \text{ pro } dL = n \cdot \pi$$

$$n = 1, 2, \dots, \infty$$

$$\Rightarrow d = \frac{n \cdot \pi}{L}$$

$$\sqrt{\frac{E}{S}} \downarrow$$
$$Q_{on} = C_0 \frac{\pi}{L} \cdot n$$

$$\Rightarrow \frac{Q_{on}}{C_0} = d = \frac{n \pi}{L}$$

Vlastne točne funkcije

$$\Phi_n(x) = C_n \cos dx + D_n \sin dx$$

\downarrow
 \varnothing

$$\Phi_n(x) = C_n \cos\left(\frac{n\pi}{L} \cdot x\right) + D_n \sin\left(\frac{n\pi}{L} \cdot x\right)$$

\downarrow
 \varnothing

$$\Phi_n(x) = D_n \sin\left(\frac{n\pi}{L} \cdot x\right)$$