Deseto predavanje
(13. svibnja 2022.)

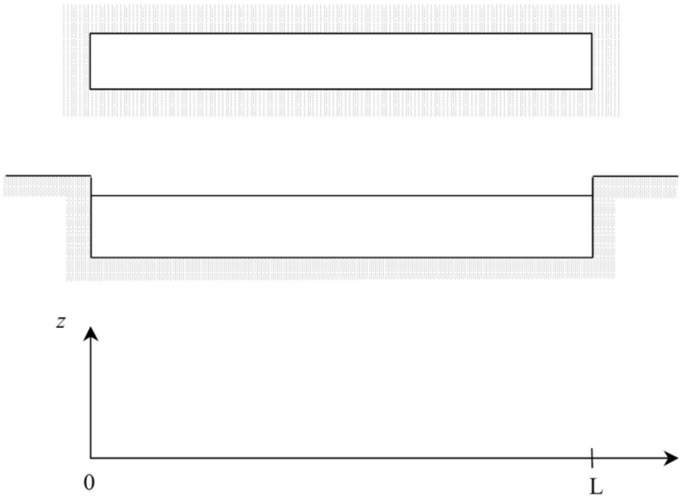
Prigušenje seša u uskom pravokutnom bazenu

Polazne jednadžbe (1)

$$\frac{\partial U}{\partial t} = -g\frac{\partial \zeta}{\partial x} + \frac{1}{\rho D}\left[\tau_x - \tau_{xD}\right]$$

$$\frac{\partial V}{\partial t} = -g\frac{\partial \zeta}{\partial y} + \frac{1}{\rho D}\left[\tau_y - \tau_{yD}\right]$$

$$\frac{\partial (DU)}{\partial x} + \frac{\partial (DV)}{\partial y} + \frac{\partial \zeta}{\partial t} = 0$$



Zanemarujemo djelovanje vjetra, pretpostavljamo $V = 0$ i $D = \text{const.}$

Polazne jednadžbe (2)

$$\frac{\partial U}{\partial t} = -g\frac{\partial \zeta}{\partial x} - \frac{\tau_{xD}}{\rho D}$$

$$D\frac{\partial U}{\partial x} + \frac{\partial \zeta}{\partial t} = 0\,,$$

$$\tau_{xD} = k\rho U = rD\rho U\,, \qquad k = rD$$

Rješavanje

$$U = \mathrm{Re}\left[U_c(x)e^{-(\delta+i\sigma)t}\right]$$

$$\zeta = \mathrm{Re}\left[Z_c(x)e^{-(\delta+i\sigma)t}\right],$$

$$\downarrow$$

$$\frac{d^2U_c(x)}{dx^2} + \varepsilon^2 U_c(x) = 0$$

$$\varepsilon^2 = \frac{(\delta + i\sigma)(-\delta - i\sigma + r)}{gD}.$$

Rješenje

$$\zeta_n = a_n \frac{D}{\sqrt{gD}} e^{-\delta t} \cos\frac{n\pi}{L} x \cos\left(\sigma_n t - b_n - \arctan\frac{r}{2\sigma_n}\right)$$

$$U_n = a_n e^{-\delta t} \sin\frac{n\pi}{L} x \sin\left(\sigma_n t - b_n\right)$$

$$\delta = \frac{r}{2}$$

$$\sigma_n^2 = \left(\frac{n\pi}{L}\right)^2 gD - \frac{r^2}{4}$$