Osmo predavanje
(6. svibnja 2022.)

3. Seši u okrajnjim bazenima

3.2. Adijabatski problem za pravokutni bazen

Polazne jednadžbe

$$\frac{\partial u}{\partial t} - fv = -\frac{1}{\rho}\frac{\partial p}{\partial x} + \frac{1}{\rho}\frac{\partial}{\partial z}\left(A\frac{\partial u}{\partial z}\right)$$

$$\frac{\partial v}{\partial t} + fu = -\frac{1}{\rho}\frac{\partial p}{\partial y} + \frac{1}{\rho}\frac{\partial}{\partial z}\left(A\frac{\partial v}{\partial z}\right)$$

$$0 = -\frac{1}{\rho}\frac{\partial p}{\partial z} - g$$

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

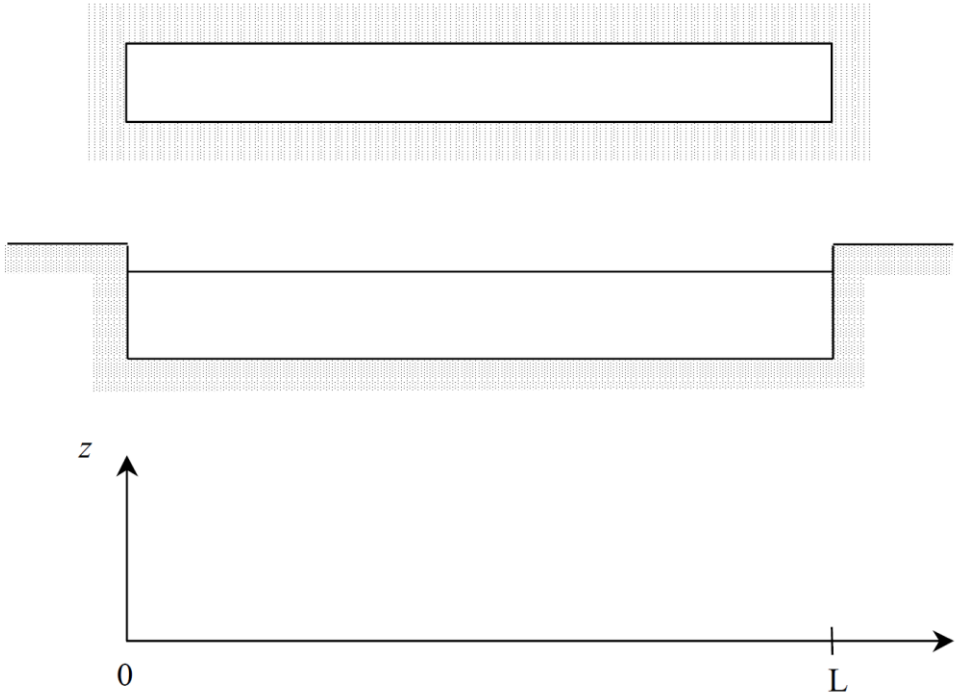
Integracija duž vertikale i zanemarenje Coriolisovog ubrzanja

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

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

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

Slobodni valovi u uskom pravokutnom bazenu



$$\frac{\partial U}{\partial t} = -g\frac{\partial \zeta}{\partial x}$$

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

Rješenje

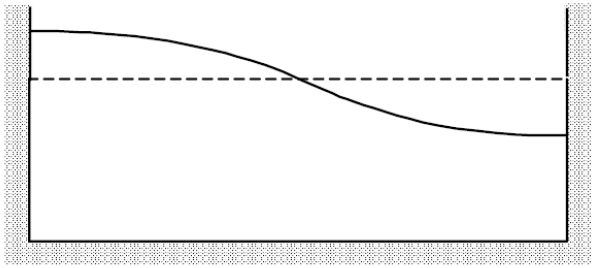
$$U_n = a_n \sin \kappa_n x \sin\left(\sigma_n t - b_n\right)$$

$$\zeta_n = a_n \frac{D}{\sqrt{gD}} \cos \kappa_n x \cos\left(\sigma_n t - b_n\right)$$

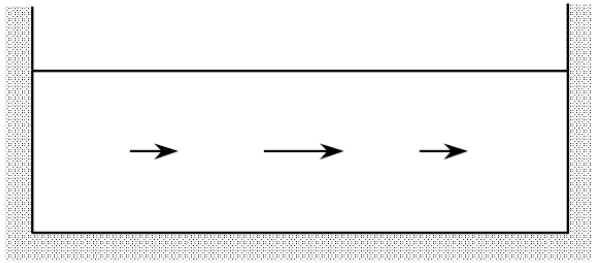
$$\kappa = \kappa_n = \frac{n\pi}{L}, \qquad \sigma_n = \frac{n\pi}{L}\sqrt{gD}, \qquad n = 1,2,3,\ldots$$

Ilustracija rješenja

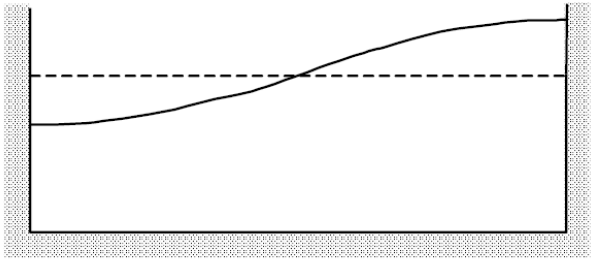
$t = t_0$



$t = t_0 + \dfrac{\pi}{2\sigma_1}$



$t = t_0 + \dfrac{\pi}{\sigma_1}$



$t = t_0 + \dfrac{3\pi}{2\sigma_1}$