

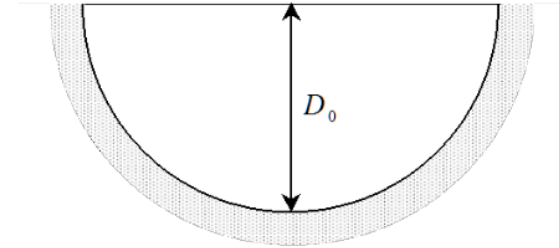
4.3. Topografski valovi - Rotacijski paraboloid

Jednadžbe za plitki fluid u cilindarskom k.s.

$$\frac{\partial c_r}{\partial t} - f c_t = -g \frac{\partial \zeta}{\partial r}$$

$$\frac{\partial c_t}{\partial t} + f c_r = -g \frac{1}{r} \frac{\partial \zeta}{\partial \theta}$$

$$\frac{1}{r} \frac{\partial (r c_r D)}{\partial r} + \frac{1}{r} \frac{\partial (c_t D)}{\partial \theta} + \cancel{\frac{\partial \zeta}{\partial t}} = 0 .$$



$$D(r) = D_0 \left[1 - \left(\frac{r}{R} \right)^2 \right]$$

Jednadžba vrtložnosti

$$\frac{\partial}{\partial t} \left[\frac{\partial}{\partial r} \left(\frac{r}{D} \frac{\partial \Psi}{\partial r} \right) + \frac{1}{r} \frac{\partial}{\partial \theta} \left(\frac{1}{D} \frac{\partial \Psi}{\partial \theta} \right) \right] + f \left[\frac{\partial}{\partial \theta} \left(\frac{1}{D} \right) \frac{\partial \Psi}{\partial r} - \frac{\partial}{\partial r} \left(\frac{1}{D} \right) \frac{\partial \Psi}{\partial \theta} \right] = 0 .$$

$$\Psi_k(r, \theta, t) = \Phi(r) e^{i(k\theta - \omega t)} ;$$

$$\left[1 - \left(\frac{r}{R} \right)^2 \right] \left(\Phi'' + \frac{1}{r} \Phi' - \frac{k^2}{r^2} \Phi \right) + \frac{2r}{R^2} \Phi' + \frac{2fk}{\omega R^2} \Phi = 0 .$$

4.3. Rotacijski paraboloid

$$\Phi_1(r_1) = r_1^s \sum_{m=0}^{\infty} A_m r_1^m = \sum_{m=0}^{\infty} A_m r_1^{m+s}. \quad r_1 = \frac{r}{R}.$$

Rekurzivna relacija

$$A_1 = A_3 = A_5 = \dots = A_{2n-1} = 0$$

$$A_m = -\frac{(n-k-m)[n+k-(6-m)]}{m(m+2k)} A_{m-2}, \quad m = 2, 4, 6, \dots$$

$$k^2 + \frac{2fk}{\omega} = n^2 - 6n + 8 =$$

(→ disperzivna relacija)

$$= (n-2)(n-4).$$

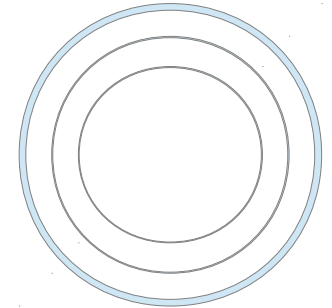
4.3. Rotacijski paraboloid

Amplituda strujne funkcije:

$$\Phi(r) = \left(\frac{r}{R}\right)^k \sum_{m=0}^{\infty} A_m \left(\frac{r}{R}\right)^m, \quad \rightarrow \quad \Phi(r) = A_0 \left(\frac{r}{R}\right)^k F\left[\alpha, \beta, \delta, \left(\frac{r}{R}\right)^2\right],$$

$$\text{R.U.: } \vec{v} \cdot \vec{n} = c_r = 0 \quad \rightarrow \quad \Phi(r=R) = 0 \quad \rightarrow \quad F(\alpha, \beta, \delta, 1) = 0 \quad \rightarrow$$

$$n = -k - 2j, \quad j = 0, 1, 2, \dots \quad \text{broj \u010dvorinih kru\u017enica}$$



Disperzivna relacija:

$$\omega_{kj} = f \frac{k}{2(j+2)(k+j+1) - k} > 0$$



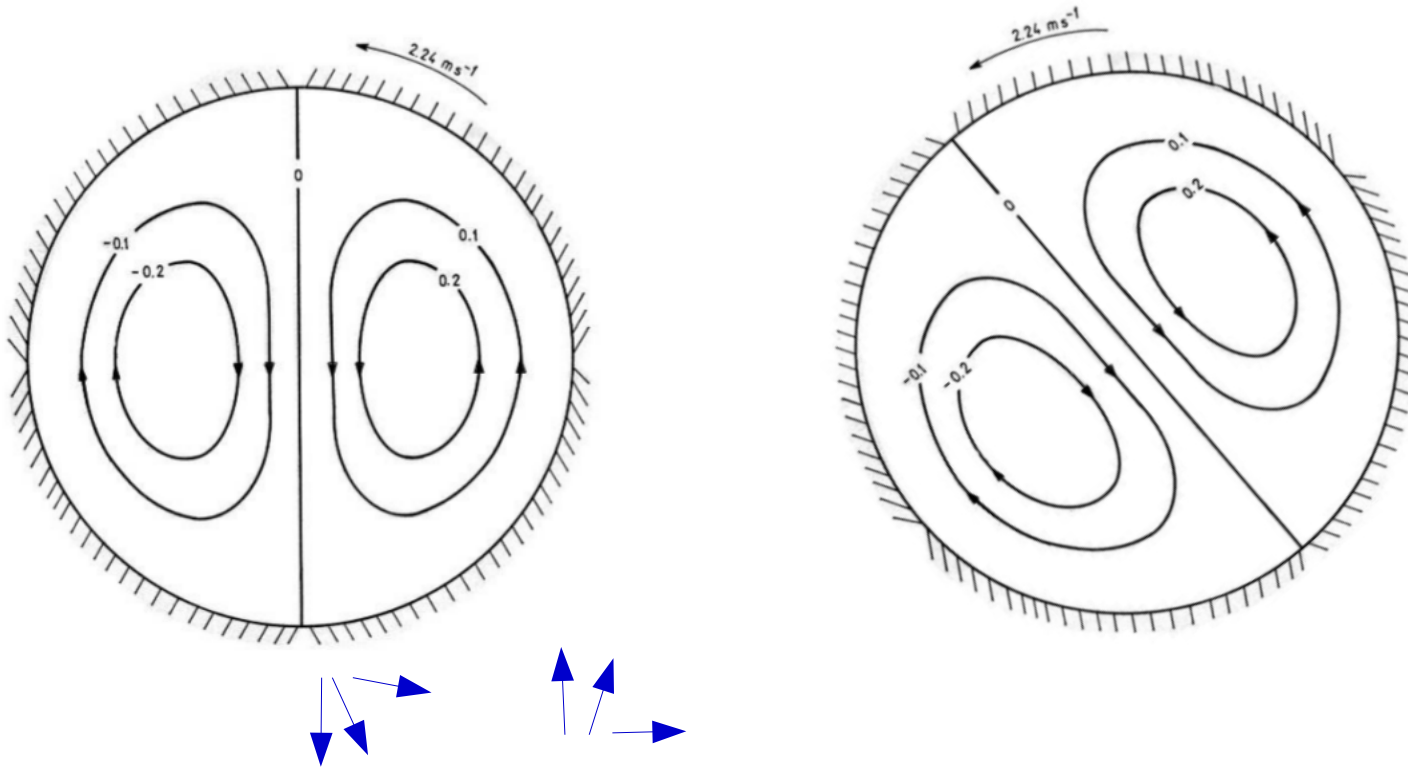
k: broj \u010dvorinih dijametara

4.3. Rotacijski paraboloid

Primjer:

mod $j = 0$, $k = 1$, u času $t = 0$

$$\Psi_{k0}(r, \theta, t = 0) = \mathcal{R}e\{\Phi_{k0}(r) \cdot e^{ik\theta}\} = \Phi_{k0}(r) \cos k\theta, \quad \Phi_{k0}(r) = A_0 \left(\frac{r}{R}\right)^k \left(\frac{D}{D_0}\right)^2.$$

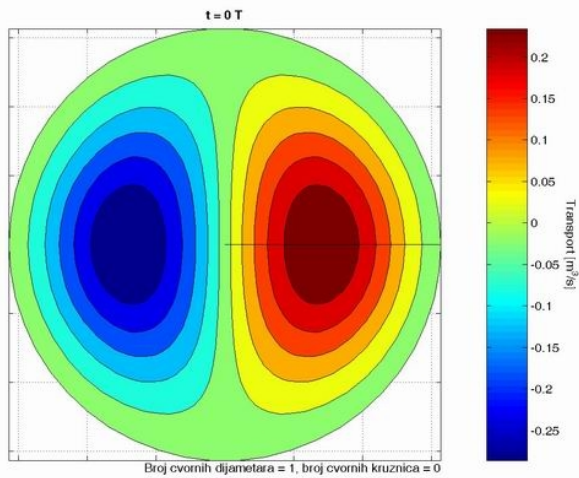


$$\omega_{k0} = f \frac{k}{3k + 4}. \quad \omega_{10} = f / 7$$

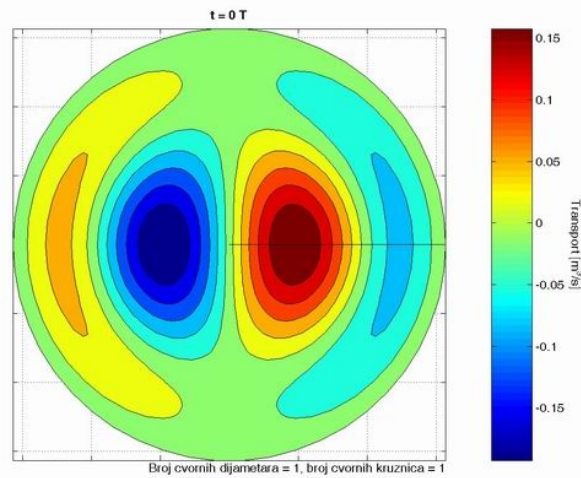
4.3. Rotacijski paraboloid

strujna funkcija u času $t = 0$

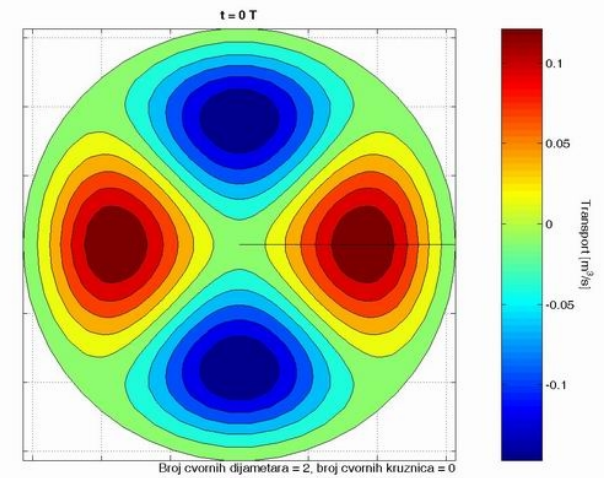
mod $k = 1, j = 0$



mod $k = 1, j = 1$



mod $k = 2, j = 0$



4.3. Rotacijski paraboloid

Mala internet škola oceanografije: <http://skola.gfz.hr>

http://skola.gfz.hr/matlab_primjeri/topo_p_1_0.gif

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