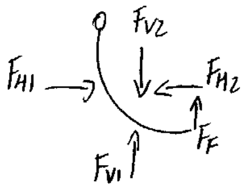
PAUTA P#1 EJ#2

Solucionamos para una altura genérica de agua, $h = H + h(t) = H + Kt$

DCL:



$$\sum \vec{T} = 0 \Leftrightarrow F_{H_1}\cdot r_{H_1} + F_{V_1}\cdot r_{V_1} + F_F\cdot a - F_{V_2}\cdot r_{V_2} - F_{H_2}\cdot r_{H_2} = 0 \quad (0{,}5)$$

$$r_{V_1} = r_{V_2} = R - \frac{4R}{3\pi} = a\left(1-\frac{4}{3\pi}\right); \quad F_{V_1} - F_{V_2} = \ldots \Rightarrow F_{V_1} - F_{V_2} = -\gamma K t a b \quad (1{,}0)$$

$F_{H1} = p_G \cdot A$; pero, la proyección del cuarto de cilindro es un rectángulo

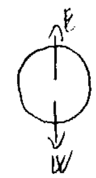
$$\Rightarrow F_{H_1} = \gamma\left(d+\frac{a}{2}\right)\cdot ab; \quad F_{H_2} = \gamma\left(d+\frac{a}{2}+Kt\right)ab \quad (0{,}5)$$

Para los brazos horizontales, $y_p = y_{CG} + \frac{I_c}{y_{CG}A}$

$$\Rightarrow r_{H_1} = d+\frac{a}{2} + \frac{ba^3}{12\left(d+\frac{a}{2}\right)\cdot ba} - d = \frac{a}{2} + \frac{a^2}{12\left(d+\frac{a}{2}\right)} = \frac{a}{2} + \frac{a^2}{6(2d+a)} = \frac{a}{2}\left(1+\frac{a}{3(2d+a)}\right) \quad (1{,}0)$$

$$r_{H_2} = d+\frac{a}{2}+Kt + \frac{ba^3}{12\left(d+\frac{a}{2}+Kt\right)} - d - Kt = \frac{a}{2} + \frac{a^2}{12\left(d+\frac{a}{2}+Kt\right)} = \frac{a}{2} + \frac{a^2}{6(2d+a+2Kt)} = \frac{a}{2}\left(1+\frac{a}{3(2d+a+2Kt)}\right) \quad (1{,}0)$$

F_F:



$$F_F = E - W = \gamma V - \rho_A g V = V(\gamma - \rho_A g) = \frac{4}{3}\pi R^3(t)(\gamma - \rho_A g) \quad (1{,}0)$$

$$\therefore \gamma\left(d+\frac{a}{2}\right)ab\cdot\frac{a}{2}\left(1+\frac{a}{3(2d+a)}\right) - \gamma K t a b a\left(1-\frac{4}{3\pi}\right) + \frac{4}{3}\pi R^3(t)(\gamma-\rho_A g)a - \gamma\left(d+\frac{a}{2}+Kt\right)ab\frac{a}{2}\left(1+\frac{a}{3(2d+a+2Kt)}\right)$$

$$\frac{4}{3}\pi R^3(t)(\gamma-\rho_A g) = \gamma ab\left[\frac{1}{2}\left(d+\frac{a}{2}+Kt\right)\left(1+\frac{a}{3(2d+a+2Kt)}\right) + Kt\left(1-\frac{4}{3\pi}\right) - \frac{1}{2}\left(d+\frac{a}{2}\right)\left(1+\frac{a}{3(2d+a)}\right)\right]$$

$$\Rightarrow R(t) = \sqrt[3]{\frac{3\gamma ab}{4\pi(\gamma-\rho_A g)}\left[\frac{1}{2}\left(d+\frac{a}{2}+Kt\right)\left(1+\frac{a}{3(2d+a+2Kt)}\right) + Kt\left(1-\frac{4}{3\pi}\right) - \frac{1}{2}\left(d+\frac{a}{2}\right)\left(1+\frac{a}{3(2d+a)}\right)\right]} \quad (0{,}5)$$

$$\Rightarrow R(t) = \sqrt[3]{\frac{3\cdot 10.250\cdot 1\cdot 3}{4\pi(10.250-1{,}29\cdot 9{,}8)}\left[\frac{1}{2}\left[\left(5+\frac{1}{2}+9\cdot 10^{-5}t\right)\left(1+\frac{1}{3(10+1+18\cdot 10^{-5}t)}\right) + 9\cdot 10^{-5}t\left(1-\frac{4}{3\pi}\right) - \frac{1}{2}\left(5+\frac{1}{2}\right)\left(1+\frac{1}{3(10+1)}\right)\right]\right]}$$

$$\Rightarrow R(t) = 1{,}19\sqrt[3]{0{,}717\left(0{,}5\left(5{,}5+9\cdot 10^{-5}t\right)\left(1+\frac{1}{33+54\cdot 10^{-5}t}\right) + 5{,}18\cdot 10^{-5}t - 2{,}83\right)}$$