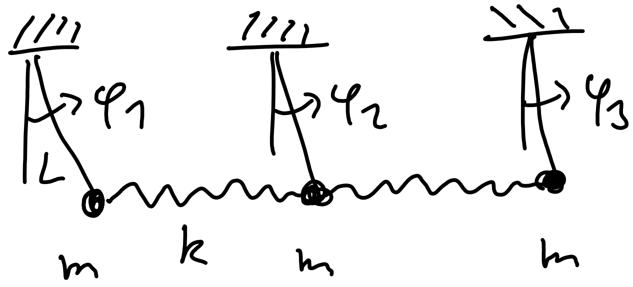
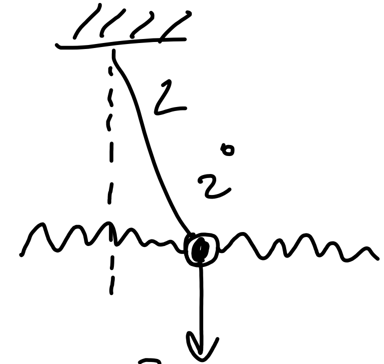
Cvičení



pohybové rovnice pro malé výchylky

$$J\ddot{\varphi} = M$$



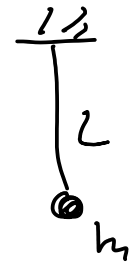
$$mL^2\ddot{\varphi}_i = -mgL\varphi_i + L\left[kL(\varphi_{i+1}-\varphi_i) - kL(\varphi_i-\varphi_{i-1})\right]$$

$$\ddot{\varphi}_i = -\frac{g}{L}\varphi_i + \frac{k}{m}\left(\varphi_{i-1} - 2\varphi_i + \varphi_{i+1}\right)$$ pohyb. rovnice pro i-té kyvadlo

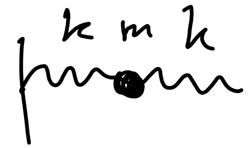
$$\varphi_i = \Phi_i \cos\omega t \quad \rightarrow \quad \omega^2\phi_i = \underbrace{\frac{g}{L}}_{\omega_k^2}\phi_i + \underbrace{\frac{2k}{m}}_{\omega_p^2}\left(\phi_i - \frac{1}{2}\phi_{i-1} - \frac{1}{2}\phi_{i+1}\right)$$

$$\begin{pmatrix} \ddots & \ddots & \ddots & & \\ & -\frac{1}{2}\omega_p^2 & \omega_k^2+\omega_p^2 & -\frac{1}{2}\omega_p^2 & \\ & & \ddots & \ddots & \ddots \end{pmatrix} \begin{pmatrix} \vdots \\ \phi_{i-1} \\ \phi_i \\ \phi_{i+1} \\ \vdots \end{pmatrix} = \omega^2 \begin{pmatrix} \vdots \\ \phi_{i-1} \\ \phi_i \\ \phi_{i+1} \\ \vdots \end{pmatrix}$$

$$\begin{pmatrix} \ddots & \ddots & & & \\ \ddots & \omega_k^2+\omega_p^2 & -\frac{\omega_p^2}{2} & 0 & \\ & -\frac{\omega_p^2}{2} & \omega_k^2+\omega_p^2 & -\frac{\omega_p^2}{2} & \\ & 0 & -\frac{\omega_p^2}{2} & \omega_k^2+\omega_p^2 & \ddots \\ & & & \ddots & \ddots \end{pmatrix}$$



$$\omega_k = \sqrt{\frac{g}{L}}$$



$$\omega_p = \sqrt{\frac{2k}{m}}$$

k diagonalizaci

Vztekliny

$c\,\Delta x^2 > \Delta t$

S, I, R S ... susceptible I ... infected R ... rabid

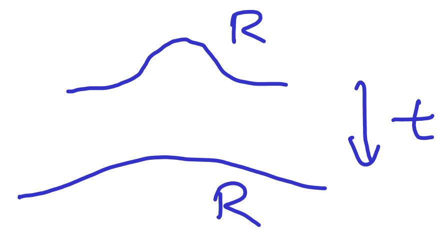
$$\frac{dS}{dt} = (a-b)\,S\left(1-\frac{N}{K}\right) - \beta R S$$

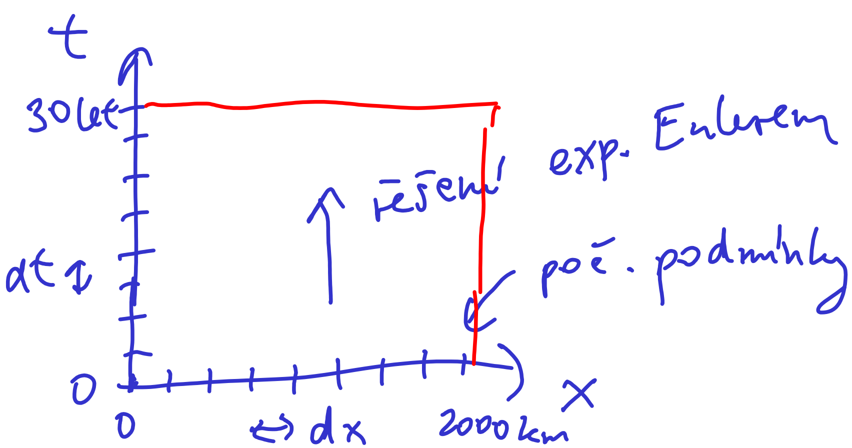
$$\frac{dI}{dt} = -bI - \frac{(a-b)N}{K}\,I + \beta R S - \sigma I$$

$$\frac{dR}{dt} = -bR - \frac{(a-b)N}{K}\,R + \sigma I - \alpha R + D\,\frac{\partial^2 R}{\partial x^2}$$

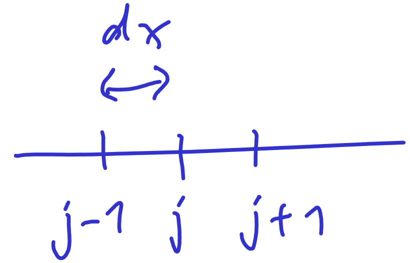
a ... natalita
b ... mortalita
K ... kapacita populace

všechny lišky $N = S + I + R$





laplacián



$$\frac{R_{j-1} - 2R_j + R_{j+1}}{dx^2} \approx \frac{\partial^2 R}{\partial x^2}$$

Tsunami

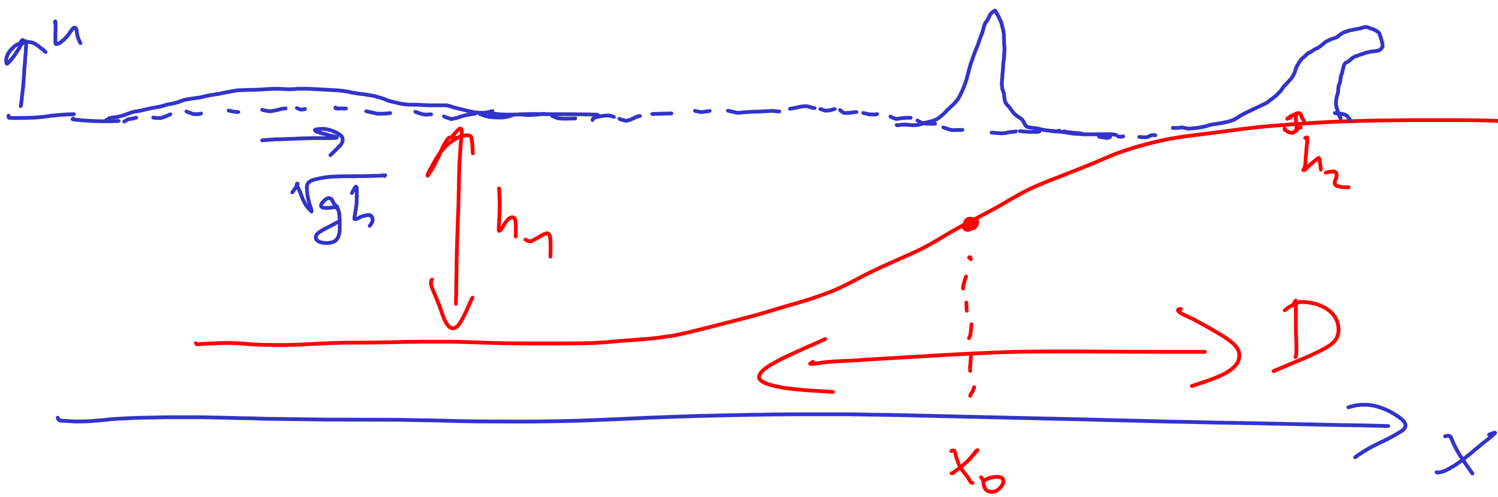
$$\frac{\partial^2 u}{\partial t^2} = g \frac{\partial}{\partial x}\left(h \frac{\partial u}{\partial x}\right)$$

$g \approx 9{,}81\ m s^{-2}$

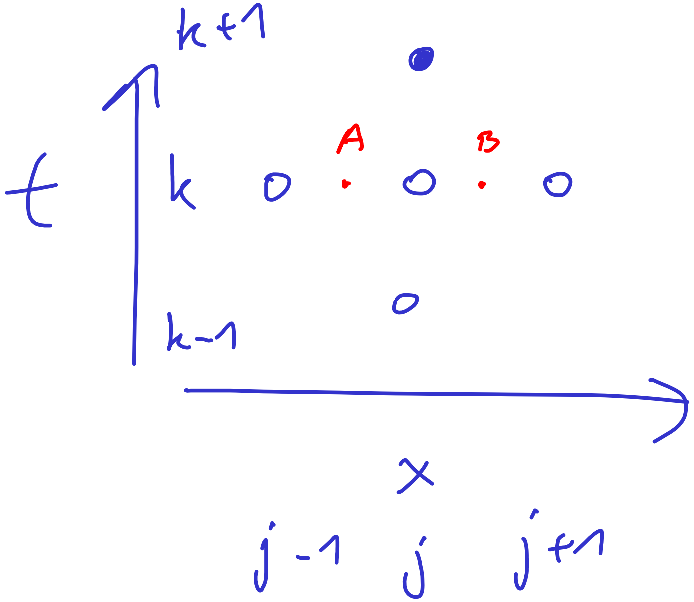
h ... hloubka vody

konst. h $\rightarrow$ $$\frac{1}{\sqrt{gh}^2}\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$$

rychlost vln $\sqrt{gh}$



$$h(x) = \frac{h_1 + h_2}{2} - \frac{h_1 - h_2}{2} \cdot \tanh \frac{x - x_0}{D}$$



$$\frac{\partial^2 u}{\partial t^2} = g \frac{\partial}{\partial x}\left(h \frac{\partial u}{\partial x}\right)$$

$$(\ )\quad(\ )$$

$$\frac{u_j^{k+1} - 2u_j^k + u_j^{k-1}}{dt^2} = g \, \frac{B - A}{dx}$$

$$\frac{h_{j+\frac{1}{2}} \dfrac{u_{j+1}^k - u_j^k}{dx} - h_{j-\frac{1}{2}} \dfrac{u_j^k - u_{j-1}^k}{dx}}{dx}$$