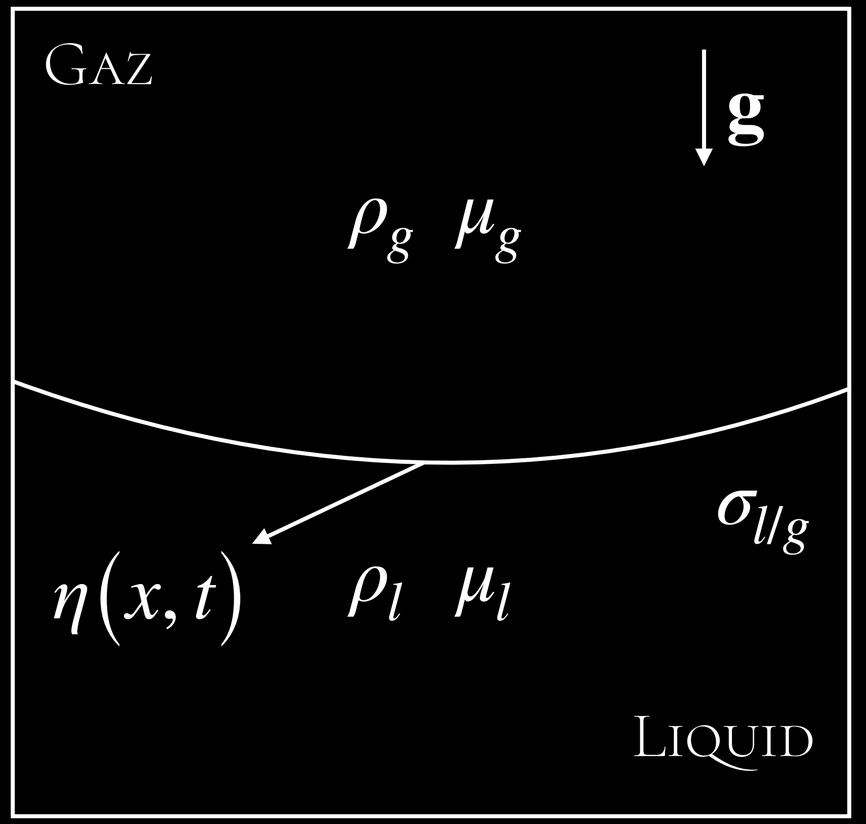
First example wit Basilisk

Wave Generation and Harmonic Oscillator Analysis.

Ilies Haouche - 04/03/2026

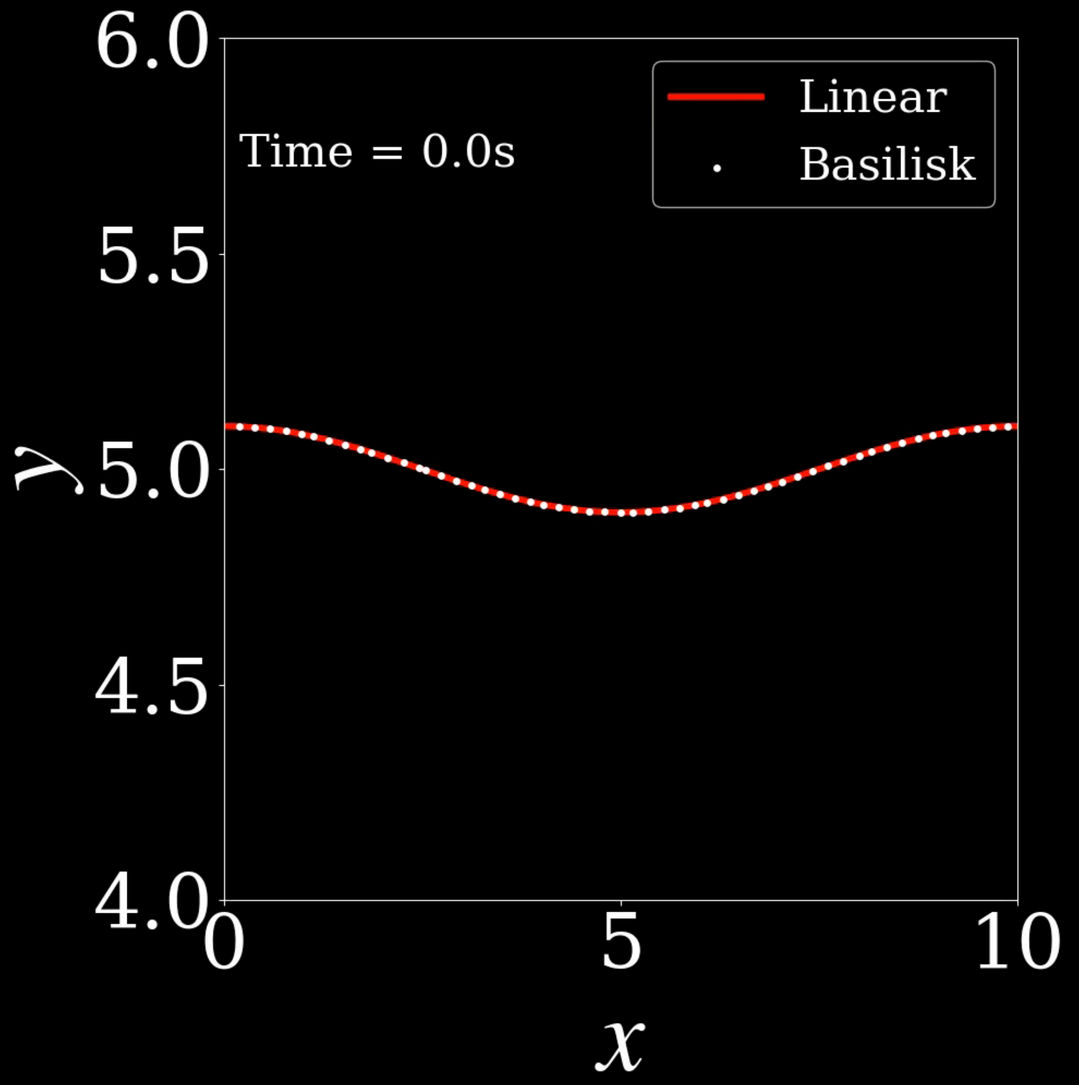
Problem Formulation



Mathematical Formulation without viscosity

- $\ddot{a}(t) + \omega_0^2 a(t) = 0$
- $a(t=0) = a_0$
- $\dot{a}(t=0) = 0$

$$\omega_0 = \sqrt{\frac{gk(\rho_0 - \rho_1)}{(\rho_0 + \rho_1)} + \frac{\sigma_{l/g} k^3}{(\rho_0 + \rho_1)}}$$



Mathematical Formulation with viscosity

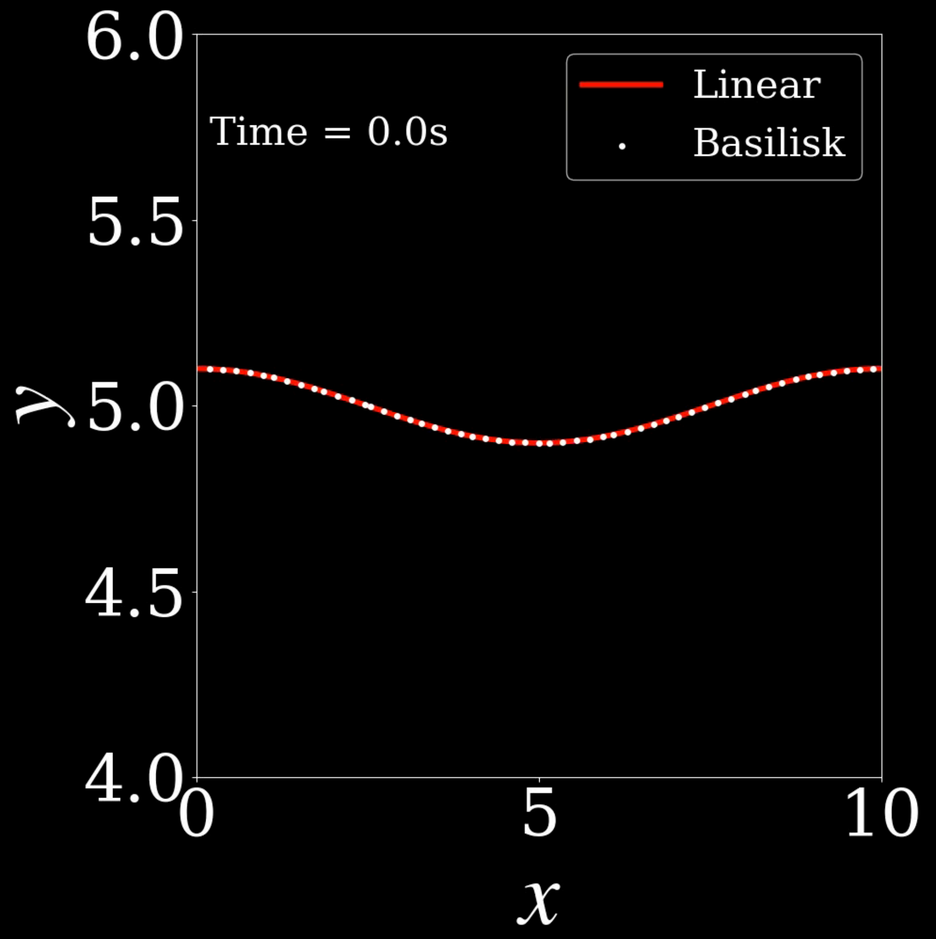
- $$\ddot{a}(t) + c_0\dot{a}(t) + \omega_0^2 a(t) + \frac{\mu_0 k}{(\rho_0+\rho_1)}\left(\int_{-\infty}^{0}\Omega_0(z,t)e^{kz}dz - \Omega_0(0,t)\right) + \frac{\mu_1 k}{(\rho_0+\rho_1)}\left(\int_{0}^{\infty}\Omega_1(z,t)e^{-kz}dz - \Omega_1(0,t)\right) = 0$$

- $a(t=0) = a_0$

- $\dot{a}(t=0) = 0$

$$c_0 = 2k^2\frac{(\mu_0+\mu_1)}{(\rho_0+\rho_1)}$$

$$\omega_0 = \sqrt{\frac{gk(\rho_0-\rho_1)}{(\rho_0+\rho_1)} + \frac{\sigma_{l/g}k^3}{(\rho_0+\rho_1)}}$$



A. Prosperetti, « Motion of two superposed viscous fluids », 1981, Vol. 24, No. 7, Phys. Fluids