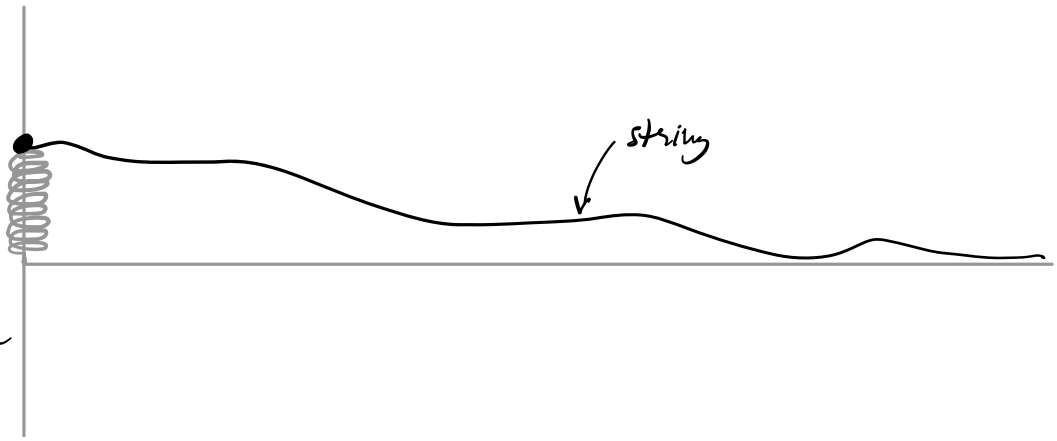
Robin boundary condition:

An example of a Robin BC is when an end of a string is free to move up and down on a track, but is pulled back by a spring or rubber band.



Other important PDEs:

Wave eq. in higher dimensions: $u_{tt} = c^2 \Delta u$

For a round drumhead we can separate variables $u(r,\theta,t) = R(r)\Theta(\theta)T(t)$ to get:

$$T''R\Theta = c^2\left(R''\Theta T + \frac{1}{r}R'\Theta T + \frac{1}{r^2}\Theta'' RT\right)$$

$$\Rightarrow \quad \frac{T''}{c^2 T} = \frac{R''}{R} + \frac{R'}{rR} + \frac{\Theta''}{r^2\Theta} = -\lambda$$

So that for R, Θ we get: $\dfrac{r^2R''}{R} + \dfrac{rR'}{R} + \underbrace{\dfrac{\Theta''}{\Theta}}_{-\gamma} = -\lambda$

$$\rightarrow \quad \begin{cases} T'' + c^2\lambda T = 0 \\ \Theta'' + \gamma\Theta = 0 \\ R'' + \frac{1}{r}R' + \left(\lambda - \frac{\gamma}{r^2}\right)R = 0 \end{cases}$$

We have an interplay between two parameters λ, γ.

Maxwell's equations: These described the behaviour of electric and magnetic fields in the presence of charges and currents.

$\vec{E} : \mathbb{R}^3 \to \mathbb{R}^3$ electric field

$\vec{B} : \mathbb{R}^3 \to \mathbb{R}^3$ magnetic field

c = speed of light

$\rho : \mathbb{R}^3 \to \mathbb{R}_+$ charge density

$\vec{j} : \mathbb{R}^3 \to \mathbb{R}^3$ current density

$$\begin{cases} \dfrac{\partial \vec{E}}{\partial t} = c\nabla \times \vec{B} - 4\pi \vec{j} & \nabla \cdot \vec{E} = 4\pi\rho \\ \dfrac{\partial \vec{B}}{\partial t} = -c\nabla \times \vec{E} & \nabla \cdot \vec{B} = 0 \end{cases}$$