

For continental lithosphere the general equation for an elastic plate with a surface load  $qa(x)$ , end load  $P$ , and hydrostatic restoring force is:

$$D \cdot \frac{d^4}{dx^4} w(x) + P \cdot \frac{d^2}{dx^2} w(x) + (\rho_m - \rho_c) \cdot g \cdot w(x) = qa(x)$$

For a line load at  $x=0$  with no end force  $P$ , this becomes:

$$D \cdot \frac{d^4}{dx^4} w(x) + (\rho_m - \rho_c) \cdot g \cdot w(x) = 0$$

With general solution:

$$w(x) = \frac{(V_0 \cdot \alpha^3)}{8 \cdot D} \cdot e^{\left(\frac{-x}{\alpha}\right)} \cdot \left( \cos\left(\frac{x}{\alpha}\right) + \sin\left(\frac{x}{\alpha}\right) \right)$$

Now that we have the equation for the amplitude of deflection for a line load ( $V_0$  @  $x=0$ ), let's specify some parameters, let sediments ( $\rho_s$ ) fill the resulting basin, and look at it:

$$\rho_m := 3300 \cdot \frac{\text{kg}}{\text{m}^3} \quad \rho_s := 2400 \cdot \frac{\text{kg}}{\text{m}^3} \quad g := 9.8 \cdot \frac{\text{m}}{\text{sec}^2} \quad E := 7 \cdot 10^{10} \cdot \text{Pa}$$

$$v := 0.25 \quad T_e := 10 \cdot \text{km} \quad D := \frac{E \cdot T_e^3}{12 \cdot (1 - v^2)} \quad D = 6.222 \cdot 10^{21} \cdot \text{kg} \cdot \text{m}^2 \cdot \text{sec}^{-2}$$

$$V_0 := 5 \cdot 10^6 \cdot \frac{\text{kg}}{\text{m} \cdot \text{sec}^2} \text{ is the load.} \quad \alpha := \sqrt[4]{\frac{(4 \cdot D)}{g \cdot (\rho_m - \rho_s)}} \quad \alpha = 4.099 \cdot 10^4 \cdot \text{m}$$

$$x_{\text{max}} := 250 \cdot \text{km} \quad x := 0, 1000 \dots x_{\text{max}}$$

$$T_e := 15 \cdot \text{km} \quad D := \frac{E \cdot T_e^3}{12 \cdot (1 - v^2)} \quad \alpha := \sqrt[4]{\frac{(4 \cdot D)}{g \cdot (\rho_m - \rho_s)}} \quad w(x) := \left[ \frac{(-V_0 \cdot \alpha^3)}{8 \cdot D} \cdot e^{\left(\frac{-x}{\alpha}\right)} \cdot \left( \cos\left(\frac{x}{\alpha}\right) + \sin\left(\frac{x}{\alpha}\right) \right) \right] \cdot \text{km}$$

$$T_e := 5 \cdot \text{km} \quad D := \frac{E \cdot T_e^3}{12 \cdot (1 - v^2)} \quad \alpha := \sqrt[4]{\frac{(4 \cdot D)}{g \cdot (\rho_m - \rho_s)}} \quad w2(x) := \left[ \frac{(-V_0 \cdot \alpha^3)}{8 \cdot D} \cdot e^{\left(\frac{-x}{\alpha}\right)} \cdot \left( \cos\left(\frac{x}{\alpha}\right) + \sin\left(\frac{x}{\alpha}\right) \right) \right] \cdot \text{km}$$

