$Z(k) = Z(k)_{Compensation}$

"5.3.BMP"

CALCULATE THE BOUGUER GRAVITATIONAL ADMITTANCE, Z(k), FOR SURFACE AND BUIED LOADING IN CONTINENTAL REGIONS.

This Mathcad file calculates the Bouguer gravitational admittance for surface and buried loading in continental regions. The Bouguer admittance is the wavenumber parameter that describes the Bouguer anomaly associated with a unit load and its isostatic response. The Bouguer anomaly associated with loads of arbitrary shape can be calculated by multiplication of the admittance in the frequency domain with the Fourier transform of the load.

Define input parameters

Define elastic thickness,Te, average gravity, g, Poisson's ratio, v, Youngs Modulus, E, and the Universal Gravitational constant, G.

$Te := 10km$

$g := 9.81m \cdot sec^{-2}$

$v := 0.25$

$E := 10^{11}Pa$

$G := 6.67 \cdot 10^{-11} newton \cdot m^2 \cdot kg^{-2}$

Define density of the crust and mantle

$\rho\_crust := 2670kg \cdot m^{-3}$

$\rho\_mantle := 3330kg \cdot m^{-3}$

Define the mean thickness of the crust

$ZT := 35.0km$

Define the depth of buried loading

$ZL := 35.0km$

Calculate the flexural rigidity, D (flexure).

$$D := \frac{E \cdot (Te)^3}{12 \cdot \left(1 - v^2\right)}$$

Choose wavenumber interval (ie $2\pi/dx$ where dx, the distance interval, is in m).

$XKINT := 6.68 \cdot 10^{-7} m^{-1}$

Calculate the Bouguer admittance for different isostatic models

$k := 0, 1 .. 1024$

$wave_k := XKINT \cdot k km$

Surface loading :

$$Phi_k := \left[\frac{D \cdot (k \cdot XKINT)^4}{g \cdot (\rho\_mantle - \rho\_crust)} + 1\right]^{-1}$$

(See Eq. 5.18)

$$Zsurface_k := -2 \cdot \pi \cdot G \cdot 10^5 \cdot 1000 \cdot \rho\_crust \cdot Phi_k \cdot e^{-k \cdot XKINT \cdot ZT}$$

(See Eq. 5.35)

Buried loading :

$$Phi_k := \left[\frac{D \cdot (k \cdot XKINT)^4}{g \cdot (\rho\_crust)} + 1\right]^{-1}$$

(See Eq. 5.37)

$$factor_k := \frac{\left[D\cdot(k\cdot XKINT)^4 + \rho\_mantle\cdot g\right]}{(\rho\_mantle - \rho\_crust)\cdot g}$$

(See Eq. 5.40)

$$Zburied_k := 2\cdot\pi\cdot G\cdot 10^5\cdot 1000\cdot(\rho\_mantle - \rho\_crust)\cdot\left[e^{-k\cdot XKINT\cdot ZT} - \left(e^{-k\cdot XKINT\cdot ZL}\cdot factor_k\right)\right]$$