GS543 (Turorial 6) AMT/MT sounding

The apparent resistivity (ρ_a) and phase (φ) over a multi-layered model is obtained from the surface impedance Z_1 given by Vozoff (1991):

$$\rho_a(\omega) = \frac{1}{\omega\mu}|Z_1|^2, \tag{1}$$

In eq. (1) ω is the angular frequency and $\mu=\mu_0=4\pi\times10^{-7}$H/m. The surface impedance Z_1 is computed by following recurrence relation:

$$Z_i(\omega) = \frac{Z_{i+1} + T_i}{1 + S_i Z_{i+1}}$$

$$Z_n = k\sqrt{\rho_n},$$

where T_i and S_i are given by:

$$T_i = \left(k\sqrt{\rho_i}\right)\tanh\left(\frac{kh_i}{\sqrt{\rho_i}}\right), \quad S_i = \frac{1}{k\sqrt{\rho_i}}\tanh\left(\frac{kh_i}{\sqrt{\rho_i}}\right).$$

$k = (i\omega\mu)^{1/2}$, $\omega = 2\pi f$, f is frequency varying from 10^4 Hz to 1 Hz.

The term Z_1 is equation (1) will be a complex quantity and it is used to determine phase change as

$$\varphi = \tan^{-1}\left(\frac{\mathrm{Im}(Z_1)}{\mathrm{Re}(Z_1)}\right). \tag{2}$$

Apparent resistivity and phase are computed over a large frequency range to depict the variation in responses from different models shown as

Resistivity (Ωm)	Thickness (m)
5.0	0.5
25	3.5
10	**25**
7500	70
10	**10**
7500	70
10	**10**
7500	

Assignment -1: Write a Fortran program to compute the apparent resistivity and phase for the tabled model parameters using subroutine.