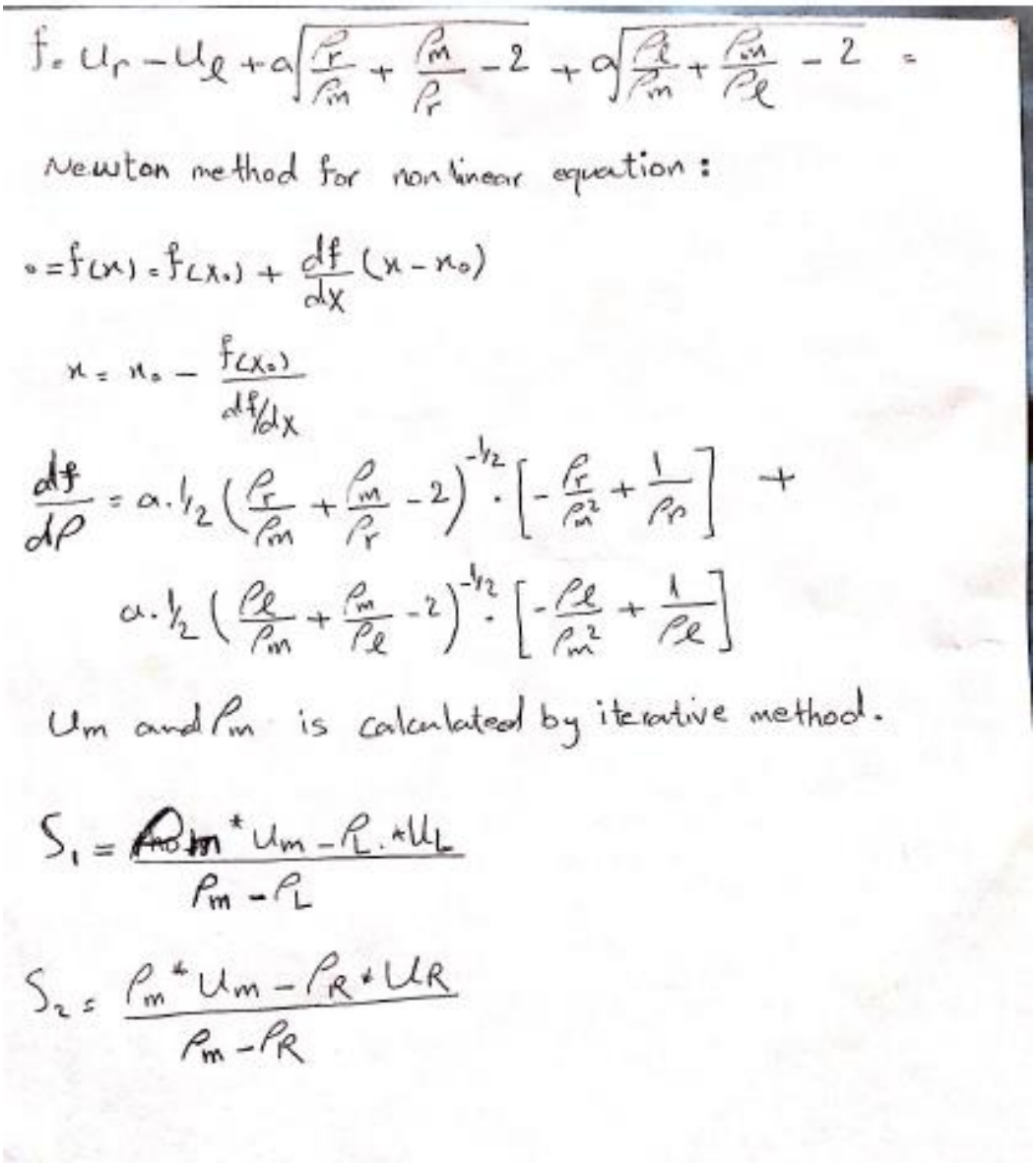
The equations of left wave and right wave for finding the medium value of density and velocity have been solved by newton methods . Also the computer simulation for all shock wave is as below :



$$f = u_r - u_l + a\sqrt{\frac{\rho_r}{\rho_m} + \frac{\rho_m}{\rho_r} - 2} + a\sqrt{\frac{\rho_l}{\rho_m} + \frac{\rho_m}{\rho_l} - 2} =$$

Newton method for nonlinear equation :

$$0 = f(x) = f(x_0) + \frac{df}{dx}(x - x_0)$$

$$x = x_0 - \frac{f(x_0)}{df/dx}$$

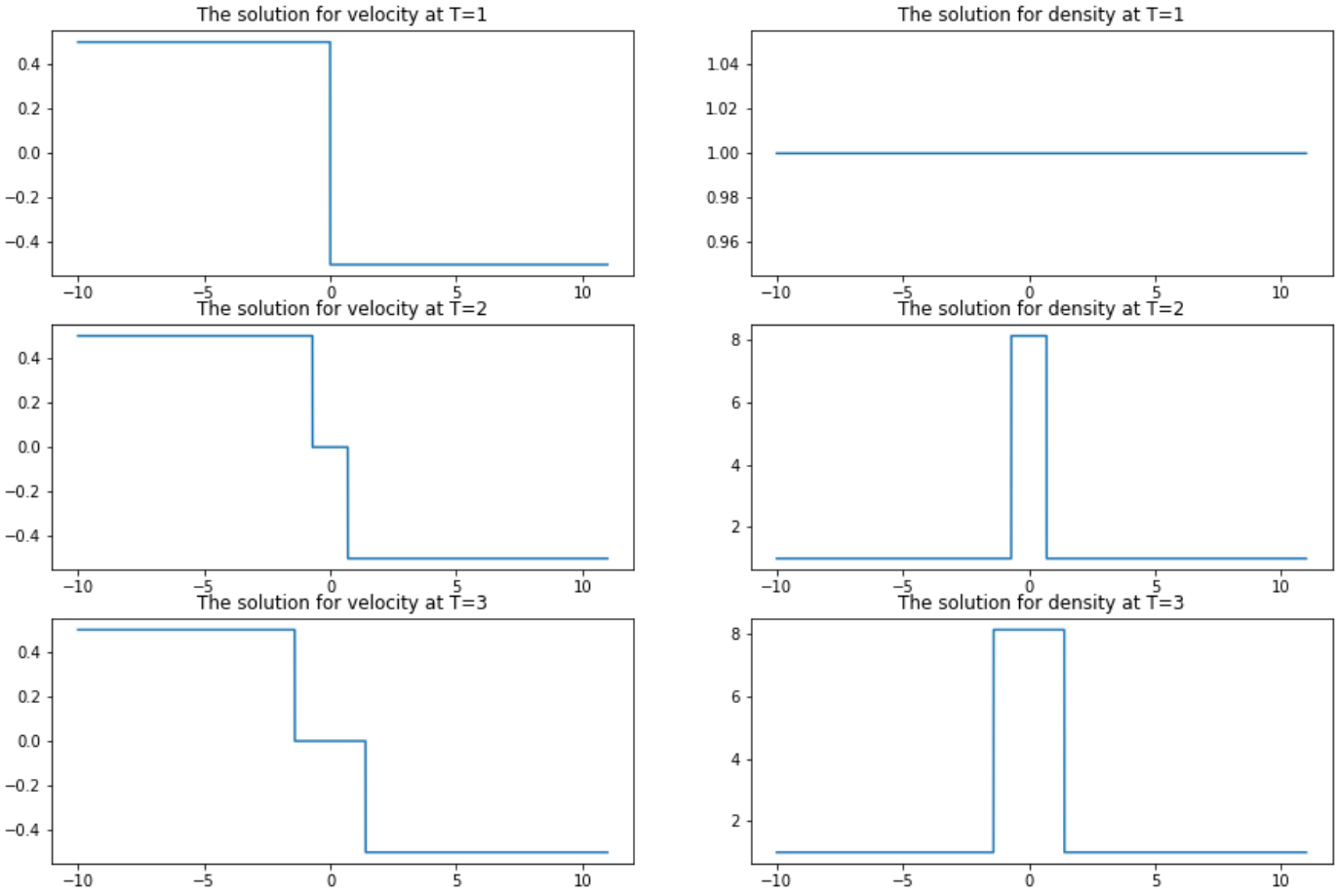
$$\frac{df}{d\rho} = a \cdot \tfrac{1}{2}\left(\frac{\rho_r}{\rho_m} + \frac{\rho_m}{\rho_r} - 2\right)^{-1/2} \cdot \left[-\frac{\rho_r}{\rho_m^2} + \frac{1}{\rho_r}\right] +$$

$$a \cdot \tfrac{1}{2}\left(\frac{\rho_l}{\rho_m} + \frac{\rho_m}{\rho_l} - 2\right)^{-1/2} \cdot \left[-\frac{\rho_l}{\rho_m^2} + \frac{1}{\rho_l}\right]$$

u_m and ρ_m is calculated by iterative method.

$$S_1 = \frac{\rho_m^* u_m - \rho_L \cdot u_L}{\rho_m - \rho_L}$$

$$S_2 = \frac{\rho_m^* u_m - \rho_R \cdot u_R}{\rho_m - \rho_R}$$



The figure of all shock wave solution. The inputs are: UL = 0.5 , UR= - 0.5 , rho_R=1 , rho_L = 1 , a = 0.2 , time interval = 10 , x interval = 0.001