Q

$$m\frac{dv}{dt} = mg - \rho_l V g - 6\pi \eta a v$$

$$\frac{dv}{dt} = \frac{\left[(\rho_m - \rho_l) V g - 6\pi \eta a v\right]}{(\rho_m V)}$$

$$= \left(\frac{\rho_m - \rho_l}{\rho_m}\right) g - \frac{6\pi \eta a v}{\rho_m V}$$

$$= \left(\frac{\rho_m - \rho_l}{\rho_m}\right) g - \frac{6\pi}{\frac{4}{3}\pi a^2 \rho_m} \eta a v$$

$$= \left(\frac{\rho_m - \rho_l}{\rho_m}\right) g - \frac{9 \eta v}{2 a^2 \rho_m}$$

Putting values

$$\frac{dv}{dt} = c_1 g - c_2 v$$

$$\int_0^v \frac{dv}{c_1 g - c_2 v} \int_0^t dt$$

$$= \ln\left(\frac{c_1 g - c_2 v}{c_1 g}\right) = -t c_2$$

$$C_1 g - C_2 V = e^{-C_2 t} C_1 g$$

$$C_2 V = K_1 g \left(1 - e^{-C_2 t}\right)$$

$$V = \frac{C_1}{C_2} g \left(1 - e^{-C_2 t}\right)$$

$$= \frac{\left(\frac{\rho_m - \rho_l}{\rho_m}\right) g \left(1 - e^{-\frac{9}{2 r^2 \rho_m} \eta t}\right)}{\left(\frac{9\eta}{2 r^2 \rho_m}\right)}$$

$$V = \left(\frac{\rho_m - \rho_l}{9\eta}\right) 2r^2 g \left(1 - e^{-\frac{9}{2 r^2 \rho_m} \eta t}\right)$$

$$V = \left(\frac{1050 \times 10^{-7} \times 2 \times 9.8}{9}\right) \left(1 - e^{-\frac{9}{2} \frac{(10^{-7})}{805} t}\right)$$

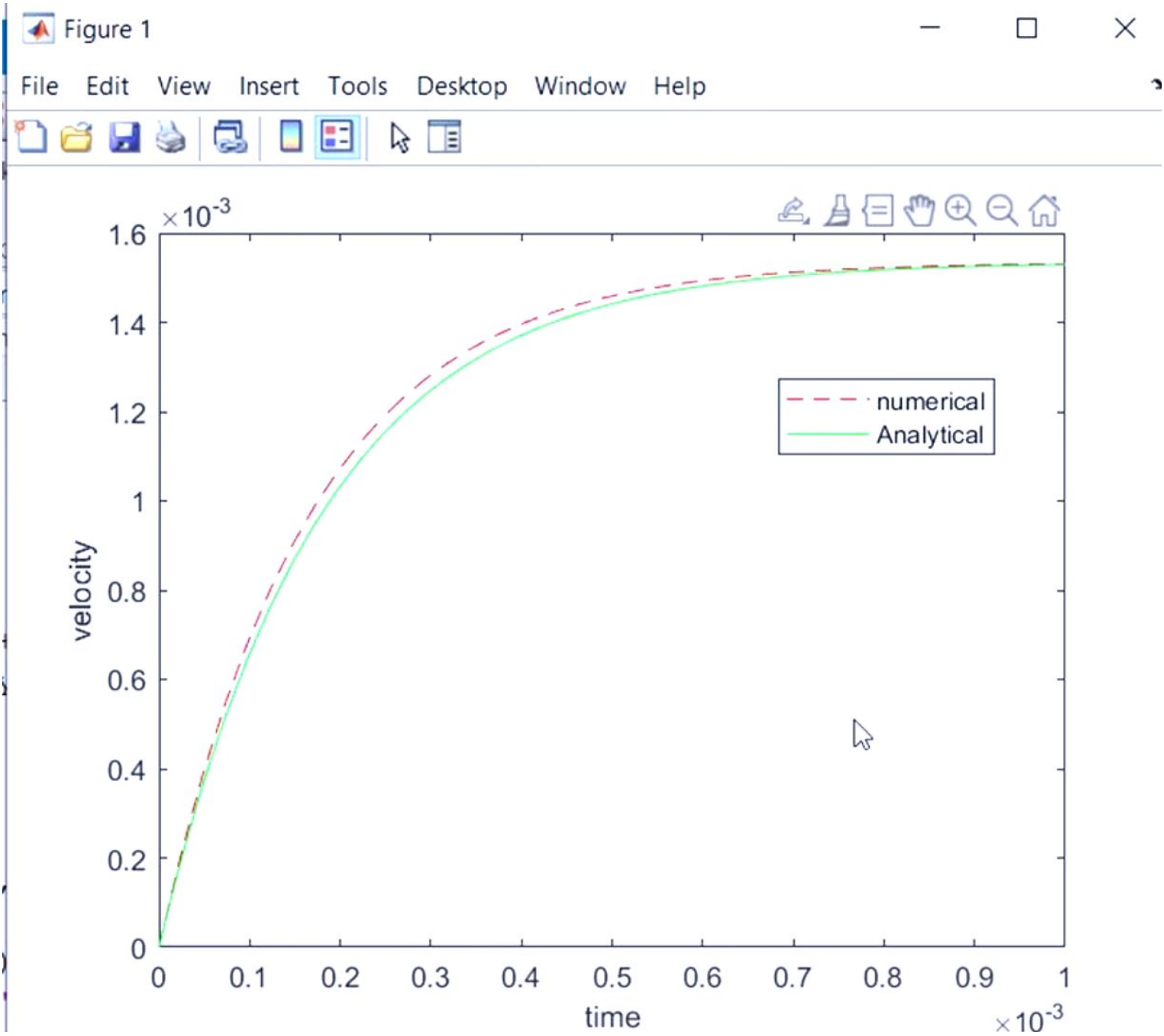
Figure 1
File Edit View Insert Tools Desktop Window Help
×10^-3
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
velocity
numerical
Analytical
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
time
×10^-3