

Force Function

kip := 1000lb

m := 0.2533

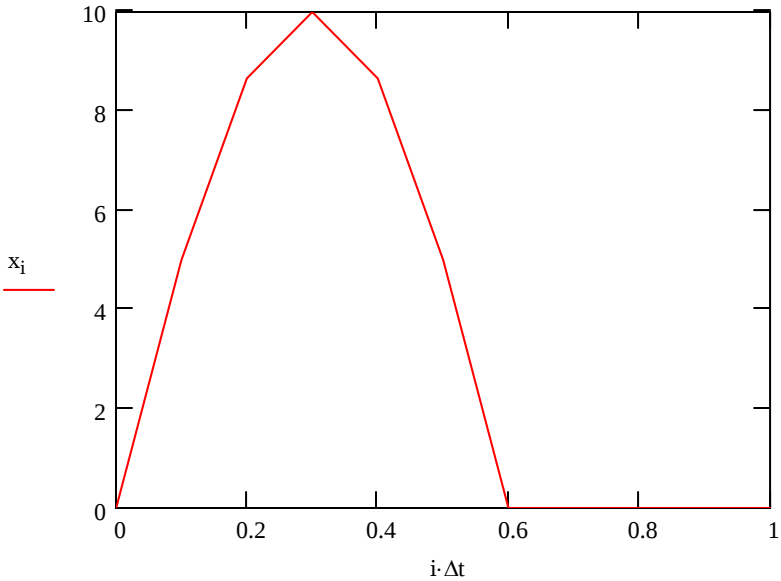
k := 10

c := 0.1592

$x := \begin{pmatrix} 0 \\ 5 \\ 8.6602 \\ 10 \\ 8.6602 \\ 5 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$

i := 0..10

Δt := 0.1



Newmark's Beta Method: Linear Systems:

$$\begin{aligned}
 & \text{uuu}(\beta, \gamma, m, c, k, \Delta t, x) := \begin{array}{l}
 \text{kbar} \leftarrow k + \frac{\gamma}{\beta \cdot \Delta t} \cdot c + \frac{1}{\beta \cdot \Delta t^2} \cdot m \\
 a \leftarrow \frac{1}{\beta \cdot \Delta t} \cdot m + \frac{\gamma}{\beta} \cdot c \\
 b \leftarrow \frac{1}{2 \cdot \beta} \cdot m + \left[\Delta t \cdot \left(\frac{\gamma}{2 \cdot \beta} - 1 \right) \right] \cdot c \\
 u_0 \leftarrow 0 \\
 \text{udot}_0 \leftarrow 0 \\
 \text{udotdot}_0 \leftarrow \frac{x_0 - c \cdot \text{udot}_0 - k \cdot u_0}{m} \\
 \text{for } i \in 0 \dots 10 \\
 \quad \begin{array}{l}
 \Delta P_i \leftarrow (x_{i+1} - x_i) \\
 \Delta P\text{bar}_i \leftarrow \Delta P_i + a \cdot \text{udot}_i + b \cdot \text{udotdot}_i \\
 \Delta u_i \leftarrow \frac{\Delta P\text{bar}_i}{\text{kbar}} \\
 \Delta \text{udot}_i \leftarrow \left[\frac{\gamma}{\beta \cdot \Delta t} \cdot \Delta u_i - \left(\frac{\gamma}{\beta} \cdot \text{udot}_i \right) + \Delta t \cdot \left(1 - \frac{\gamma}{2 \cdot \beta} \right) \cdot \text{udotdot}_i \right] \\
 \Delta \text{udotdot}_i \leftarrow \frac{1}{\beta \cdot \Delta t^2} \cdot \Delta u_i - \frac{1}{\beta \cdot \Delta t} \cdot \text{udot}_i - \frac{1}{2 \cdot \beta} \cdot \text{udotdot}_i \\
 u_{i+1} \leftarrow u_i + \Delta u_i \\
 \text{udot}_{i+1} \leftarrow \text{udot}_i + \Delta \text{udot}_i \\
 \text{udotdot}_{i+1} \leftarrow \text{udotdot}_i + \Delta \text{udotdot}_i
 \end{array} \\
 \text{umax} \leftarrow u
 \end{array}
 \end{aligned}$$

$$\beta := \frac{1}{4} \quad \gamma := \frac{1}{2}$$

$\text{disp} := \text{uuu}(\beta, \gamma, m, c, k, \Delta t, x)$

disp =

	0
0	0
1	0.044
2	0.233
3	0.612
4	1.083
5	1.431
6	1.423
7	0.962
8	0.191
9	-0.604
10	-1.144
11	-1.254

