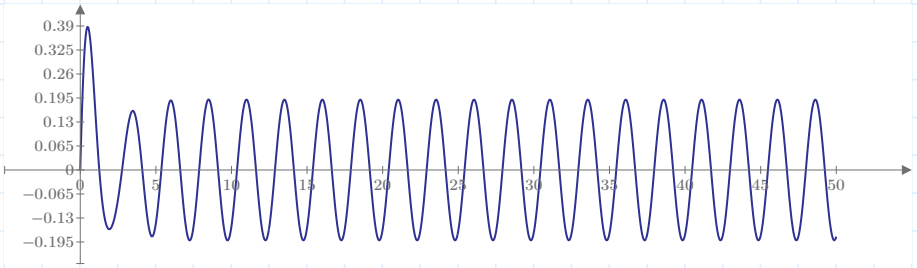
$m := 1$

$l := 1$ $\quad v_0 := 2 \cdot \sqrt{g \cdot l}$ $\quad \varphi_0 := 0$ $\quad a := l$ $\quad g := 9.80665$ $\quad k := 0.2$ $\quad v_0 := \frac{\pi}{2}$ $\quad y := \begin{bmatrix} v_0 \\ \varphi_0 \end{bmatrix}$ $\quad w_0$

$$D(t, y) := \begin{bmatrix} -w_0 \cdot y_1 \cdot 0 - 1 \cdot w_0^{\,2} \cdot \sin\left(y_1\right) - k \cdot y_0 + a \cdot \sin\left(w_1 \cdot t\right) \\ y_0 \end{bmatrix} \qquad Z := \text{rkfixed}(y, 0, 50, 2000, D)$$

$\left(Z^{\langle 2 \rangle}\right)_i$



$\left(Z^{\langle 2 \rangle}\right)_i$ $\quad -0.8$

$\left(Z^{\langle 0 \rangle}\right)_i$

$n := 20$

$h := l - l \cdot \cos\left(Z^{\langle 1 \rangle}\right) = \begin{bmatrix} 1 \\ 0.936 \\ 0.867 \\ 0.794 \\ \vdots \end{bmatrix}$ $\qquad t := 0 \,..\, n = \begin{bmatrix} 0 \\ \vdots \end{bmatrix}$ $\qquad f(t) := 1.5 \cdot \frac{t}{n}$

$$wr := \left\| \begin{array}{l} ii \leftarrow 0 \\ \text{while } ii < n \\ \quad \left\| \begin{array}{l} R(t, y) \leftarrow \begin{bmatrix} \frac{-g}{l} \cdot y_1 \cdot 1 - 0 \cdot w_0 \cdot \sin\left(y_1\right) - k \cdot y_0 + a \cdot \sin\left(w_{ii} \cdot t\right) \\ y_0 \end{bmatrix} \\ Q \leftarrow \text{rkfixed}(y, 0, 50, 200, R) \\ wr_{ii} \leftarrow \max\left(l \cdot \sin\left(Q^{\langle 2 \rangle}\right)\right) \\ ii \leftarrow ii + 1 \end{array} \right. \\ wr \end{array} \right. = \begin{bmatrix} 0.344 \\ 0.344 \\ 0.344 \\ 0.345 \\ \vdots \end{bmatrix}$$

$$Q := \text{rkfixed}(y, 0, 10, 2$$

$$A := \frac{1}{\sqrt{\left(w_0^{\,2} - w^2\right)^2 + 4\,\left(\delta^2 \cdot w^2\right)}} = \begin{bmatrix} 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \\ 0.103 \\ 0.103 \\ \vdots \end{bmatrix} \qquad \varphi := \text{atan}\left(\frac{2 \cdot \delta \cdot w}{w_0^{\,2} - w^2}\right) = \begin{bmatrix} 0 \\ 4.885 \cdot 10^{} \\ 9.771 \cdot 10^{} \\ 0.001 \\ 0.002 \\ 0.002 \\ 0.003 \\ 0.003 \\ 0.004 \\ 0.004 \\ 0.005 \\ 0.005 \\ \vdots \end{bmatrix}$$

$g := 9.80665$

$v_0 := 2 \cdot \sqrt{g \cdot l}$ $\quad \varphi_0 := 0$ $\quad a := l$ $\quad k := 0.2$ $\quad v_0 := \frac{\pi}{2}$ $\quad y := \begin{bmatrix} v_0 \\ \varphi_0 \end{bmatrix}$

$$\begin{bmatrix} w0 \leftarrow \sqrt{\frac{g}{l}} \\ h \leftarrow 0.025 \\ d \leftarrow 0.1 \\ w \leftarrow w0 \cdot 0.1 \\ v \leftarrow \frac{\pi}{24} \\ phi \leftarrow 0 \\ i \leftarrow 0 \\ m \leftarrow l \cdot \sin(phi) \\ \text{while } i < n \\ \quad \begin{bmatrix} t \leftarrow h \cdot \left(a \cdot \sin(w \cdot i \cdot h) - w0^2 \cdot \sin(phi)\right) \\ phi \leftarrow phi + h \cdot v \\ v \leftarrow v + t \\ i \leftarrow i + 1 \\ \text{if } (l \cdot \sin(phi) > m) \\ \quad m \leftarrow l \cdot \sin(phi) \end{bmatrix} \\ m \end{bmatrix} = 1$$

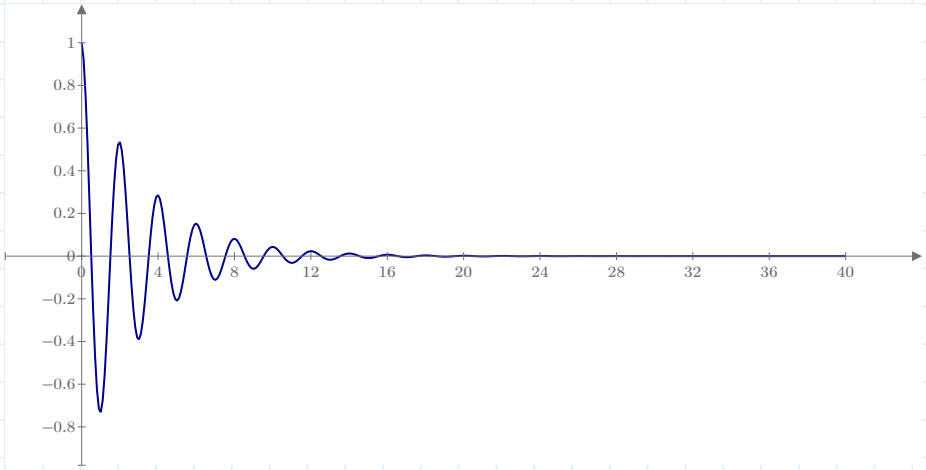
$$R(t, y) := \begin{bmatrix} \frac{-g}{l} \cdot y_1 \cdot 0 - 1 \cdot w_0 \cdot \sin\left(y_1\right) \\ y_0 \end{bmatrix}$$

$$\left(A^{\langle i \rangle}\right)_j := \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4\ b_i^{\,2} \cdot w_j^{\,2}}}$$

$t := 0, 0.1 \ldots 40 = \begin{bmatrix} 0 \\ \vdots \end{bmatrix}$

$d := 0.1$ $\quad w0 := \sqrt{\frac{g}{l}}$ $\quad w := w0$ $\quad f := 0$

$A0 := l \qquad b := d \cdot w0 \qquad X(t) := A0 \cdot e^{-b \cdot t} \cdot \cos(w \cdot t + f)$



$X(t_i)$

t_i

$n := 1000$

$m := 3 \qquad step := \frac{m}{n}$

$k := 0, step .. m = \begin{bmatrix} 0 \\ 0.003 \\ 0.006 \\ \vdots \end{bmatrix}$

$z(t) := 3 \cdot \frac{t}{m} \qquad z(k) = \begin{bmatrix} 0 \\ 0.003 \\ 0.006 \\ \vdots \end{bmatrix}$

$w := w0 \cdot k = \begin{bmatrix} 0 \\ 0.009 \\ 0.019 \\ \vdots \end{bmatrix}$

$d := 0, 0.01 .. 10 = \begin{bmatrix} 0 \\ \vdots \end{bmatrix}$

$b := w0 \cdot d$

$A_1 := \left\| \begin{array}{l} j \leftarrow 0 \\ \text{while } j < n \end{array} \right.$

$A_2 := \left\| \begin{array}{l} j \leftarrow 0 \\ \text{while } j < n \end{array} \right.$

$$\left\| \begin{array}{l} \left\| \begin{array}{l} (A)_j \leftarrow \dfrac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4\, b_{30}^{\,2} \cdot w_j^{\,2}}} \\ j \leftarrow j + 1 \end{array} \right. \\ A \end{array} \right.$$

$$\left\| \begin{array}{l} \left\| \begin{array}{l} (A)_j \leftarrow \dfrac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4} \end{array} \right. \\ j \leftarrow j + 1 \\ A \end{array} \right.$$

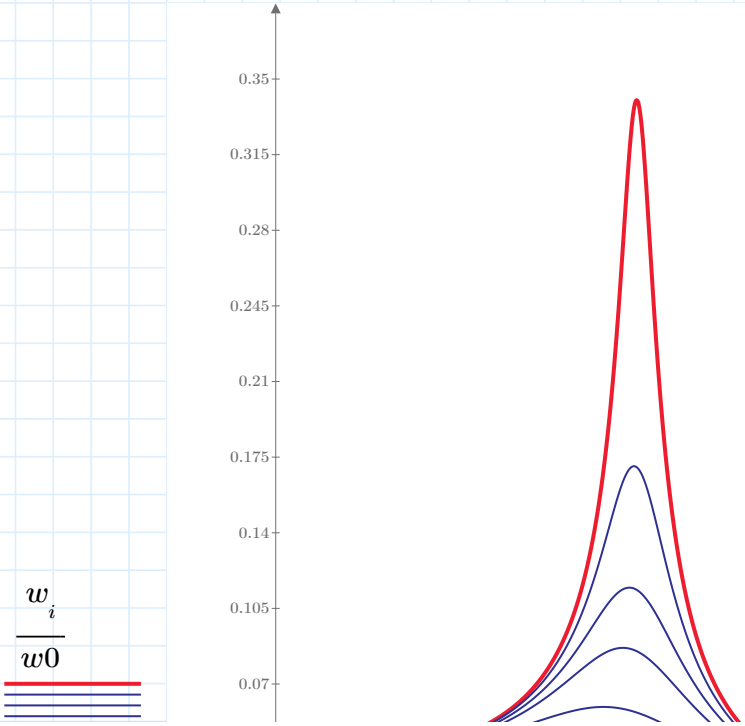
$$A_5 := \left\| \begin{array}{l} j \leftarrow 0 \\ \text{while } j \le n \\ \left\| \begin{array}{l} (A)_j \leftarrow \dfrac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4\, b_{15}^{\,2} \cdot w_j^{\,2}}} \\ j \leftarrow j + 1 \end{array} \right. \\ A \end{array} \right.$$

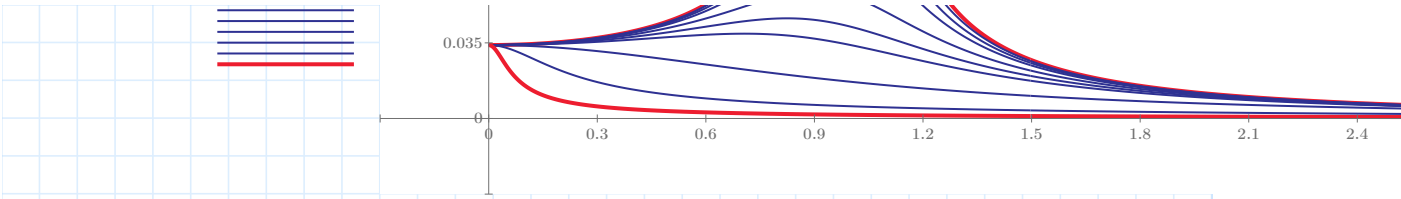
$$A_6 := \left\| \begin{array}{l} j \leftarrow 0 \\ \text{while } j \le n \\ \left\| \begin{array}{l} (A)_j \leftarrow \dfrac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4} \end{array} \right. \\ j \leftarrow j + 1 \\ A \end{array} \right.$$

$$A_9 := \left\| \begin{array}{l} j \leftarrow 0 \\ \text{while } j \le n \\ \left\| \begin{array}{l} (A)_j \leftarrow \dfrac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4\, b_{50}^{\,2} \cdot w_j^{\,2}}} \\ j \leftarrow j + 1 \end{array} \right. \\ A \end{array} \right.$$

$$A_{10} := \left\| \begin{array}{l} j \leftarrow 0 \\ \text{while } j \le n \\ \left\| \begin{array}{l} (A)_j \leftarrow \dfrac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^{\,2}\right)^2 + 4} \end{array} \right. \\ j \leftarrow j + 1 \\ A \end{array} \right.$$

$$\frac{w_i}{w0}$$




0.035
0
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4