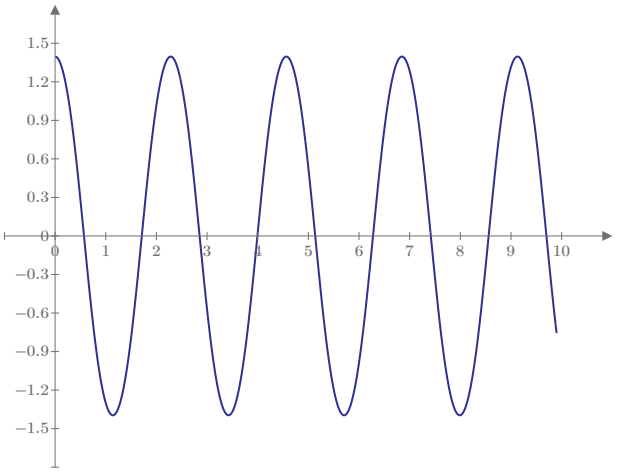
$m := 1$ $g := 9.80665$

$l := 1$ $v_0 := 2 \cdot \sqrt{g \cdot l}$ $\varphi_0 := \frac{80}{180}\,\pi$ $a := l$ $k := 0.2$ $v_0 := 0$ $y := \begin{bmatrix} v_0 \\ \varphi_0 \end{bmatrix}$ $w_0 := \sqrt{\frac{g}{l}}$

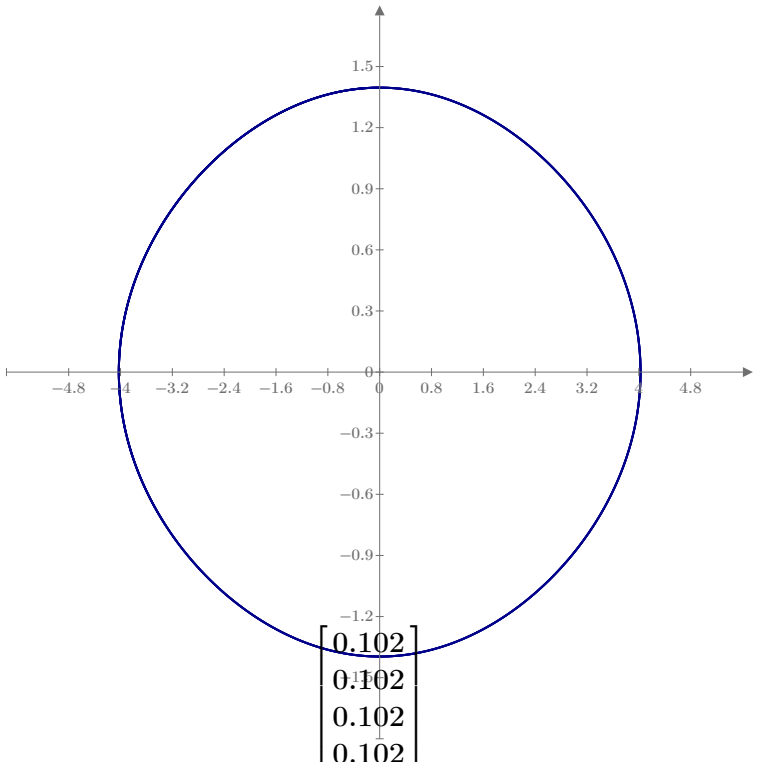
$$D(t, y) := \begin{bmatrix} -w_0^{\,2} \cdot y_1 \cdot 0 - 1 \cdot w_0^{\,2} \cdot \sin\left(y_1\right) - k \cdot y_0 + a \cdot \sin\left(w_1 \cdot t\right) \\ y_0 \end{bmatrix} \qquad Z := \text{rkfixed}\left(y, 0, 9.9, 2000, D\right) \qquad Z =$$

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



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

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



$\left(Z^{\langle 1 \rangle}\right)_i$

$$\begin{bmatrix} 0.102 \\ 0.102 \\ 0.102 \\ 0.102 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 4.885 \cdot 10^{-4} \\ 9.771 \cdot 10^{-4} \\ 0.001 \end{bmatrix}$$

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

$g := 9.80665$

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

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

$= 1$

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

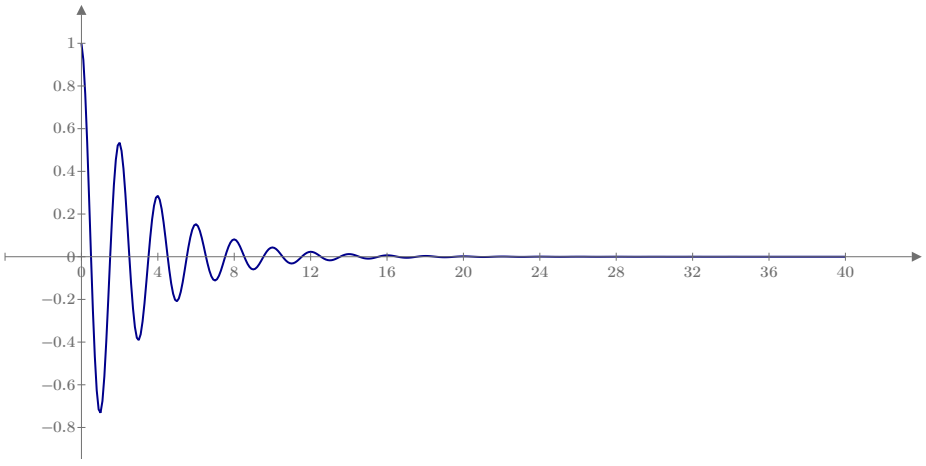
$$\left(A^{\langle i \rangle}\right)_j := \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j{}^2\right)^2 + 4\, b_i{}^2 \cdot w_j{}^2}}$$

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

$m := 1$

$d := 0.1 \qquad w0 := \sqrt{\frac{g}{l}} \qquad w := w0 \qquad f := 0 \qquad l := 1$

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



$X\left(t_i\right)$

t_i

$n := 1000$

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

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

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

$w := w0 \cdot k = \begin{bmatrix} 0 \\ 0.009 \\ 0.019 \\ \vdots \end{bmatrix} \qquad d := 0, 0.01 .. 10 = \begin{bmatrix} 0 \\ \vdots \end{bmatrix}$

$b := w0 \cdot d$

$A_1 :=$ for $j \leftarrow 0$; while $j \le n$: $(A)_j \leftarrow \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^2\right)^2 + 4\, b_{30}^2 \cdot w_j^2}}$; $j \leftarrow j + 1$; A

$A_2 :=$ for $j \leftarrow 0$; while $j \le n$: $(A)_j \leftarrow \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^2\right)^2 + 4\, b_{30}^2 \cdot w_j^2}}$; $j \leftarrow j + 1$; A

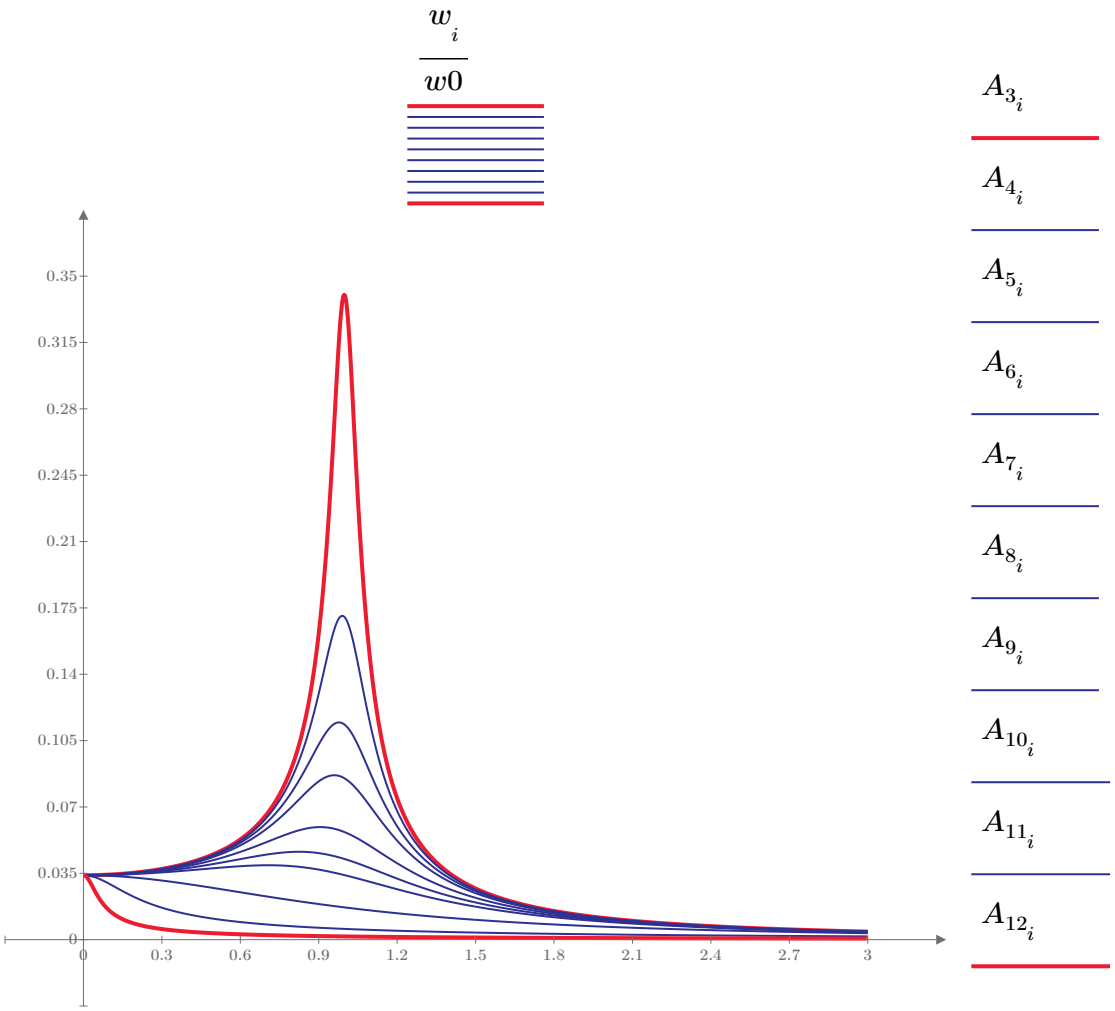
$A_5 :=$ for $j \leftarrow 0$; while $j \le n$: $(A)_j \leftarrow \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^2\right)^2 + 4\, b_{15}^2 \cdot w_j^2}}$; $j \leftarrow j + 1$; A

$A_6 :=$ for $j \leftarrow 0$; while $j \le n$: $(A)_j \leftarrow \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^2\right)^2 + 4\, b_{20}^2 \cdot w_j^2}}$; $j \leftarrow j + 1$; A

$A_9 :=$ for $j \leftarrow 0$; while $j \le n$: $(A)_j \leftarrow \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^2\right)^2 + 4\, b_{50}^2 \cdot w_j^2}}$; $j \leftarrow j + 1$

$A_{10} :=$ for $j \leftarrow 0$; while $j \le n$: $(A)_j \leftarrow \frac{A0}{m \cdot \sqrt{\left(w0^2 - w_j^2\right)^2 + 4\, b_{100}^2 \cdot w_j^2}}$; $j \leftarrow j + 1$

$\|A$ $\|A$


$\frac{w_i}{w0}$
0.35
0.315
0.28
0.245
0.21
0.175
0.14
0.105
0.07
0.035
0
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
A_{3_i}
A_{4_i}
A_{5_i}
A_{6_i}
A_{7_i}
A_{8_i}
A_{9_i}
A_{10_i}
A_{11_i}
A_{12_i}