tab :=

	0	1	2	3
0	0	0.286	-0.016	-1.682
1	$1.466 \cdot 10^{-3}$	0.286	-0.015	-1.626
2	$2.933 \cdot 10^{-3}$	0.286	-0.015	...

$T := 0.4285$ sec; time of the cycle at the speed of 14.661 rad/s as a constant velocity.

$\Theta := 2\pi$ rad; rotation of an entire cycle.

$Periodo := tab^{\langle 0 \rangle}$ $\quad j := tab^{\langle 1 \rangle}$ $\quad d\_j := tab^{\langle 2 \rangle}$ $\quad net\_load := tab^{\langle 3 \rangle}$

I've obtained the curves of the Inertia's Moment and its derivate from
a Creo Mechanism Analysis.

As units I use the international system.

The fourth column is the torque needed to move the system at a constant velocity.

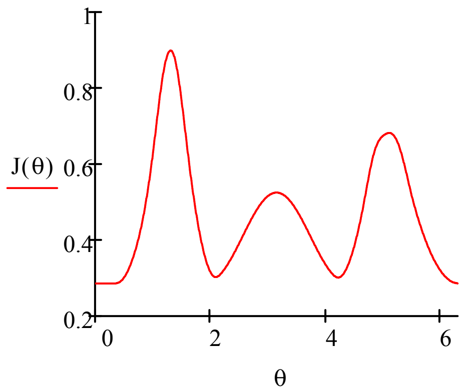
At a constant velocity (imposed) the acceleration is always 0, so I can't see the contribute of J, but only the contribute of J'.

S1 := cspline(Periodo, j)
J(θ) := interp(S1, Periodo, j, θ)

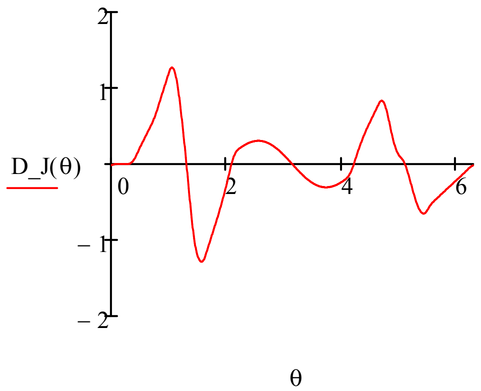
S2 := cspline(Periodo, d_j)
D_J(θ) := interp(S2, Periodo, d_j, θ)

S3 := cspline(Periodo, net_load)
Net_load(θ) := interp(S3, Periodo, net_load, θ)

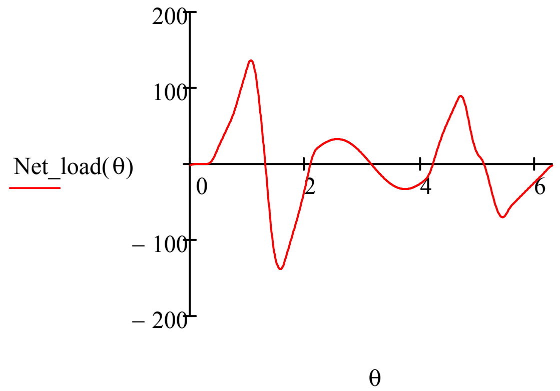
J [kg*m^2]



J' [kg*m^2]



Net Load [N*m]



$\omega_0 := 14.661$ $\quad C_0 := \frac{1}{2} \cdot D\_J(0) \cdot (\omega_0)^2$ $\quad C_0 = -1.682$

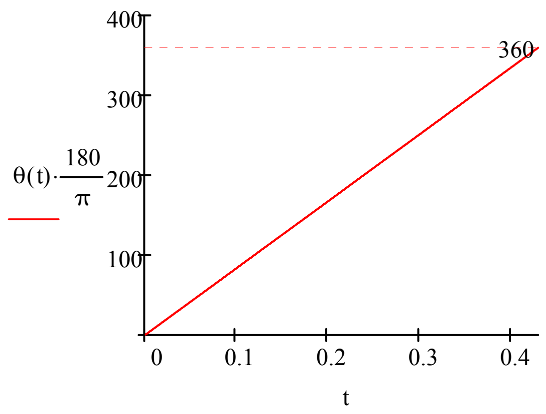
Given

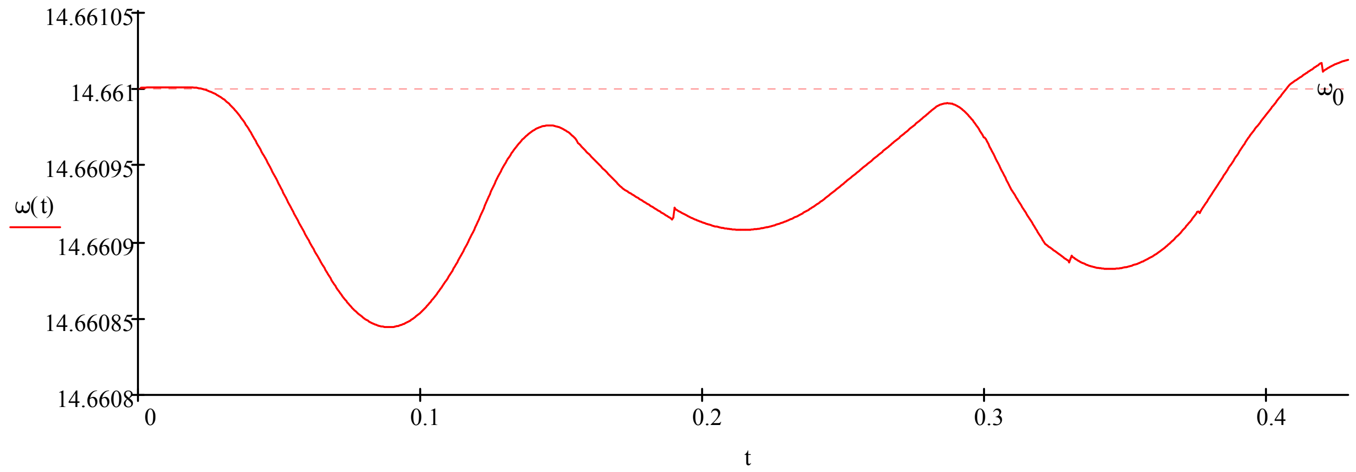
C.I. $\quad \omega(0) = \omega_0 \quad \theta(0) = 0$

Equaz. $\quad \omega(t) = \theta'(t)$

$$J(\theta(t)) \cdot \omega'(t) + \frac{1}{2} \cdot D\_J(\theta(t)) \cdot (\omega(t))^2 = Net\_load(\theta(t))$$

$$\begin{pmatrix} \omega \\ \theta \end{pmatrix} := Odesolve\left[\begin{pmatrix} \omega \\ \theta \end{pmatrix}, t, T\right]$$

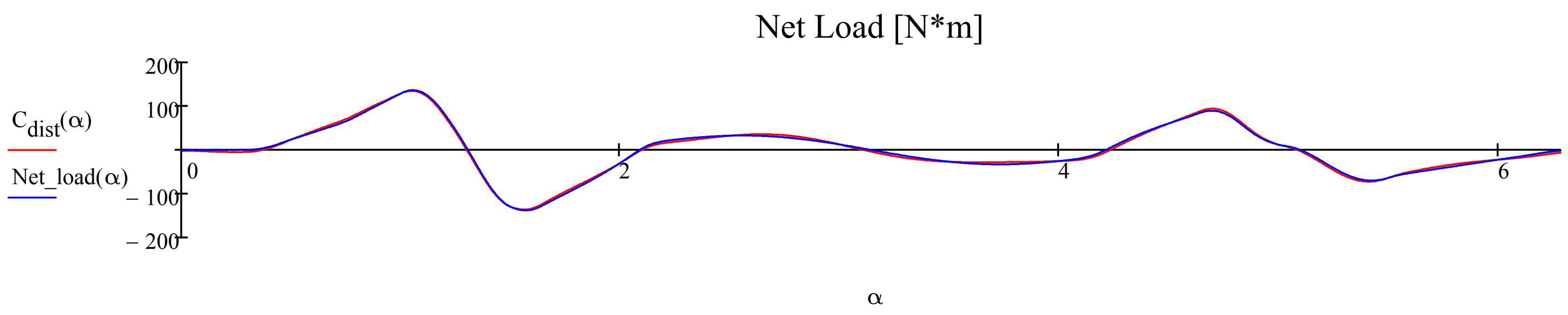




I introduce a disturb on the torque so the velocity must vary.

f_dist := 1 Hz $\quad pulsaz := 2\cdot\pi\cdot f\_dist = 6.283$

$Disturb(x) := -5\cdot\sin(pulsaz\,x)$ $\quad C_{dist}(x) := Net\_load(x) + Disturb(x)$



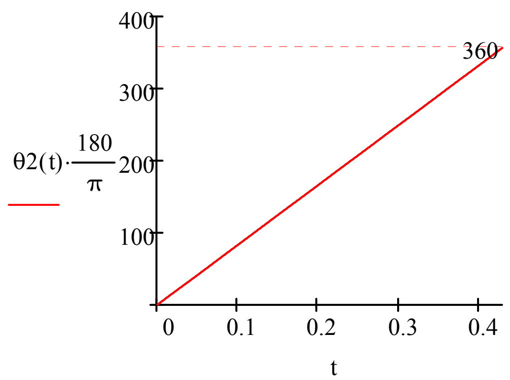
Given

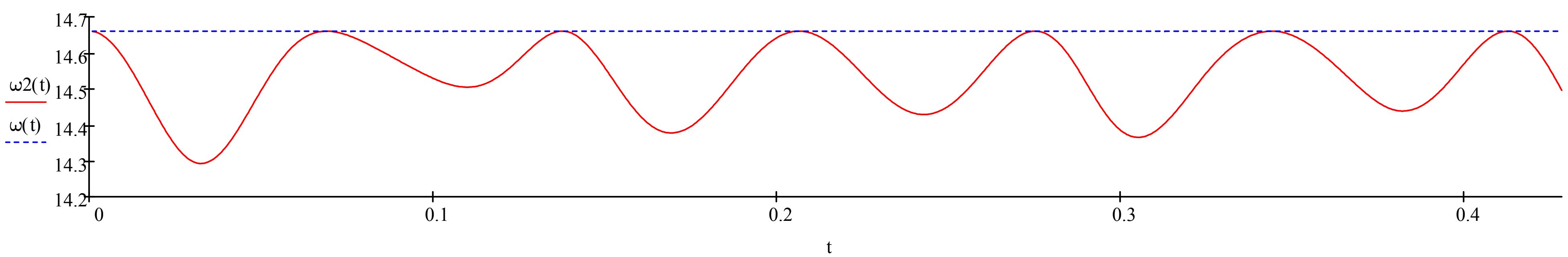
C.I. $\omega(0) = \omega_0$ $\quad \theta(0) = 0$

Equaz. $\omega(t) = \theta'(t)$

$$J(\theta(t))\cdot\omega'(t) + \frac{1}{2}\cdot D\_J(\theta(t))\cdot(\omega(t))^2 = C_{dist}(\theta(t))$$

$$\begin{pmatrix}\omega 2\\ \theta 2\end{pmatrix} := Odesolve\left[\begin{pmatrix}\omega\\ \theta\end{pmatrix}, t, T\right]$$





I increase the inertia J of 10%. Its derivative don't vary because I've added a constant part.

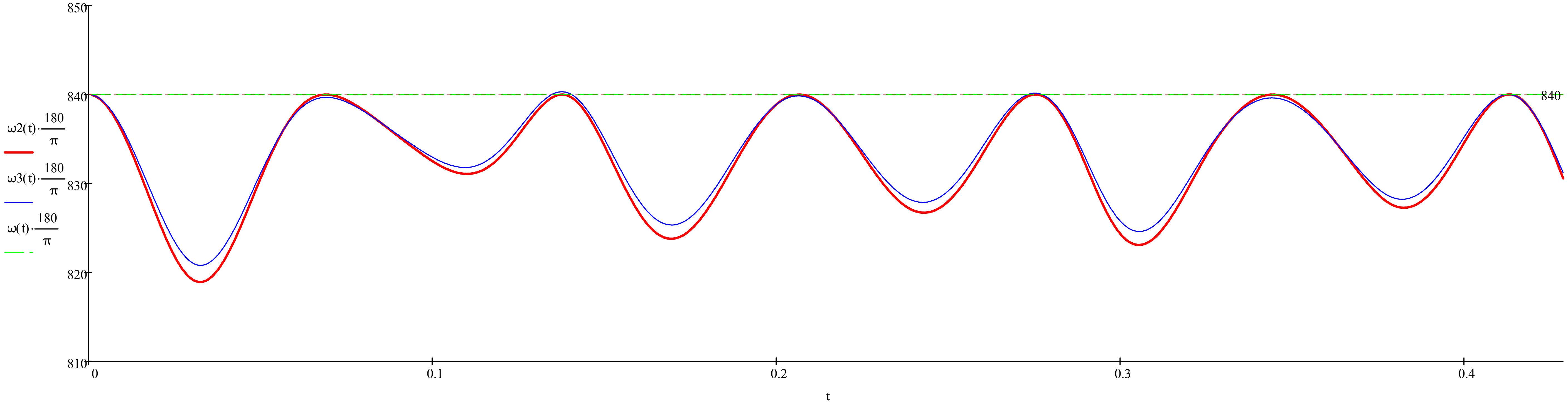
Given

C.I. $\omega(0) = \omega_0$ $\theta(0) = 0$

Equaz. $\omega(t) = \theta'(t)$

$$(J(\theta(t))\cdot 1.1)\cdot \omega'(t) + \frac{1}{2}\cdot D\_J(\theta(t))\cdot (\omega(t))^2 = C_{dist}(\theta(t))$$

$$\begin{pmatrix} \omega 3 \\ \theta 3 \end{pmatrix} := \text{Odesolve}\left[\begin{pmatrix} \omega \\ \theta \end{pmatrix}, t, T\right]$$



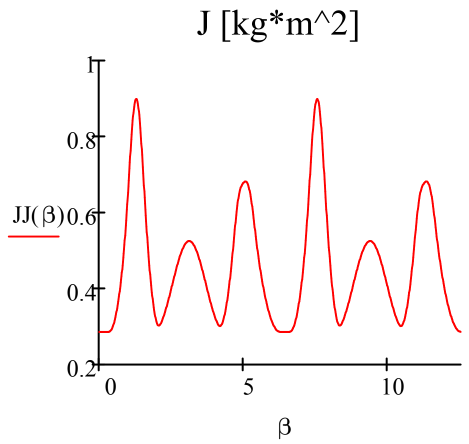
I

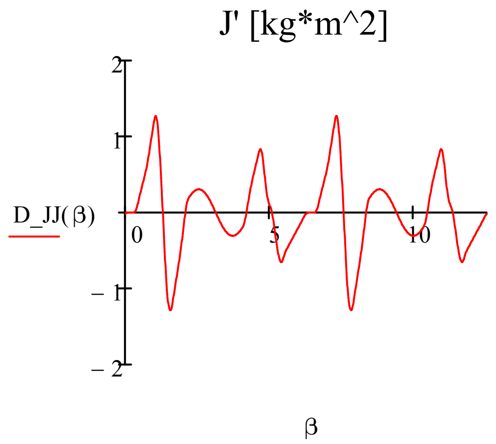
Now I try to make a feedback loop where I don't impose the torque but I let calculate her at the loop. **But I don't know how I could do...**

I make the functions J and D_J periodic of 2π.

$$JJ(\beta) := \left| \begin{array}{l} k \leftarrow \text{floor}\left(\frac{\beta}{\Theta}\right) \\ J(\beta - k\cdot\Theta) \end{array} \right.$$

$$D\_JJ(\beta) := \left| \begin{array}{l} k \leftarrow \text{floor}\left(\frac{\beta}{\Theta}\right) \\ D\_J(\beta - k\cdot\Theta) \end{array} \right.$$





$N := 1000$ $n := 1 .. N - 1$ $\Delta t := \frac{T}{N - 1}$ $t_0 := 0$ $t_n := n \cdot \Delta t$

$th_0 := 0$ rad
$\omega_0 := 14.661$ rad/s
$\gamma_0 := 0.00013$ rad/s^2
$Tr_0 := -1.682$ N*m

The equation I must resolve is this and I must impose a target velocity of 14.661 rad/s

$$J \cdot \theta'' + \frac{1}{2} \cdot J \cdot (\theta')^2 = C$$

$J = J(\theta(t))$

$J' = J'(\theta(t))$

are function only of the geometry of the system, not of the dynamic.

$\theta, \theta', \theta'' = (\theta(t), \theta'(t), \theta''(t))$

$C = C(t, \theta(t))$