> *restart*

> $Ecua := diff(q(t), t\$2) + 20 \cdot diff(q(t), t) + 200 \cdot q(t) = 150$

$$Ecua := \frac{d^2}{dt^2} q(t) + 20 \left(\frac{d}{dt} q(t) \right) + 200\, q(t) = 150 \tag{1}$$

> $CondIni := q(0) = 0, D(q)(0) = 0$

$$CondIni := q(0) = 0, D(q)(0) = 0 \tag{2}$$

> $with(inttrans):$

> $EcuaTL := subs(CondIni, laplace(Ecua, t, s))$

$$EcuaTL := s^2\, laplace(q(t), t, s) + 20\, s\, laplace(q(t), t, s) + 200\, laplace(q(t), t, s) = \frac{150}{s} \tag{3}$$

> $SolTL := isolate(EcuaTL, laplace(q(t), t, s))$

$$SolTL := laplace(q(t), t, s) = \frac{150}{s\left(s^2 + 20\,s + 200\right)} \tag{4}$$

> $SolPart := invlaplace(SolTL, s, t)$

$$SolPart := q(t) = \frac{3}{4} - \frac{3}{4}\, e^{-10\,t} \left(\cos(10\,t) + \sin(10\,t) \right) \tag{5}$$

> $Corriente := i(t) = rhs(diff(SolPart, t))$

$$Corriente := i(t) = \frac{15}{2}\, e^{-10\,t} \left(\cos(10\,t) + \sin(10\,t) \right) - \frac{3}{4}\, e^{-10\,t} \left(-10 \sin(10\,t) \right.$$
$$\left. + 10 \cos(10\,t) \right) \tag{6}$$

> $plot(rhs(Corriente), t = 0..1)$
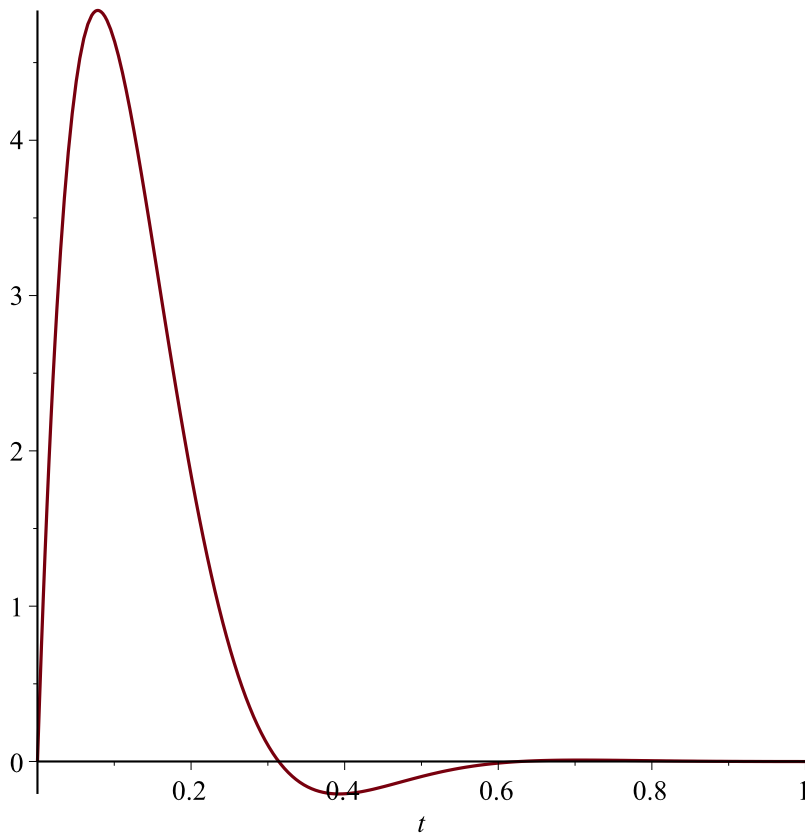
> *restart*

> $Ecua := diff(i(t), t) + 20\,i(t) = 40 \cdot \sin(120 \cdot Pi \cdot (t-2)) \cdot \text{Heaviside}(t-2)$

$$Ecua := \frac{d}{dt}\,i(t) + 20\,i(t) = 40\,\sin\big(120\,\pi\,(t-2)\big)\,\text{Heaviside}(t-2) \tag{7}$$

> $CondIni := i(0) = 0$

$$CondIni := i(0) = 0 \tag{8}$$

> $with(inttrans):$

> $EcuaTL := subs(CondIni, laplace(Ecua, t, s))$

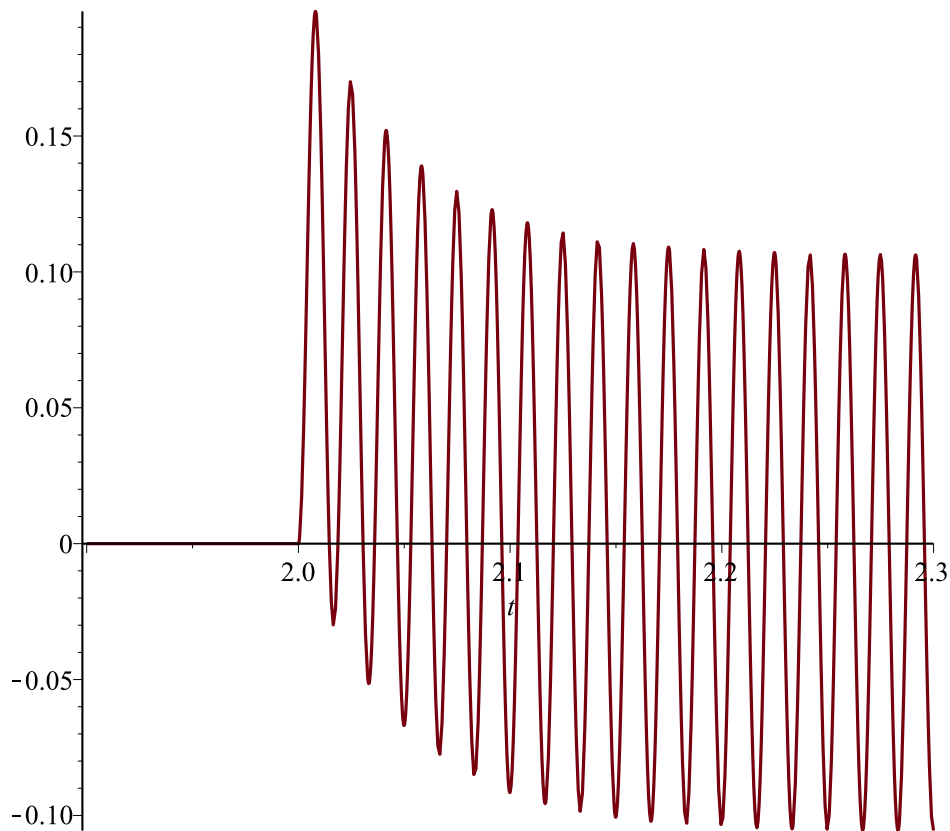$$EcuaTL := s\,laplace(i(t), t, s) + 20\,laplace(i(t), t, s) = \frac{4800\,e^{-2s}\,\pi}{14400\,\pi^2 + s^2} \tag{9}$$

> $SolTL := isolate(EcuaTL, laplace(i(t), t, s))$

$$SolTL := laplace(i(t), t, s) = \frac{4800\,e^{-2s}\,\pi}{\big(14400\,\pi^2 + s^2\big)\,(s+20)} \tag{10}$$

> $SolPart := invlaplace(SolTL, s, t)$

$$SolPart := i(t) = \frac{2\,\text{Heaviside}(t-2)\,\big(6\,e^{-20\,t+40}\,\pi - 6\,\cos(120\,\pi\,t)\,\pi + \sin(120\,\pi\,t)\big)}{36\,\pi^2 + 1} \tag{11}$$

> $plot(rhs(SolPart), t = 1.9..2.3)$

> $restart$

TORRE MAYOR

> $Sac := \left(\dfrac{487}{1000} \right) \cdot (\text{Heaviside}(t) - 2 \cdot \text{Heaviside}(t - a) + 2 \cdot \text{Heaviside}(t - 3\,a) - \text{Heaviside}(t - 4\,a))$

$$Sac := \dfrac{487}{1000}\, \text{Heaviside}(t) - \dfrac{487}{500}\, \text{Heaviside}(t - a) + \dfrac{487}{500}\, \text{Heaviside}(t - 3\,a) \qquad \textbf{(12)}$$

$$- \dfrac{487}{1000}\, \text{Heaviside}(t - 4\,a)$$

> $plot(subs(a = 5, Sac), t = 0..25)$
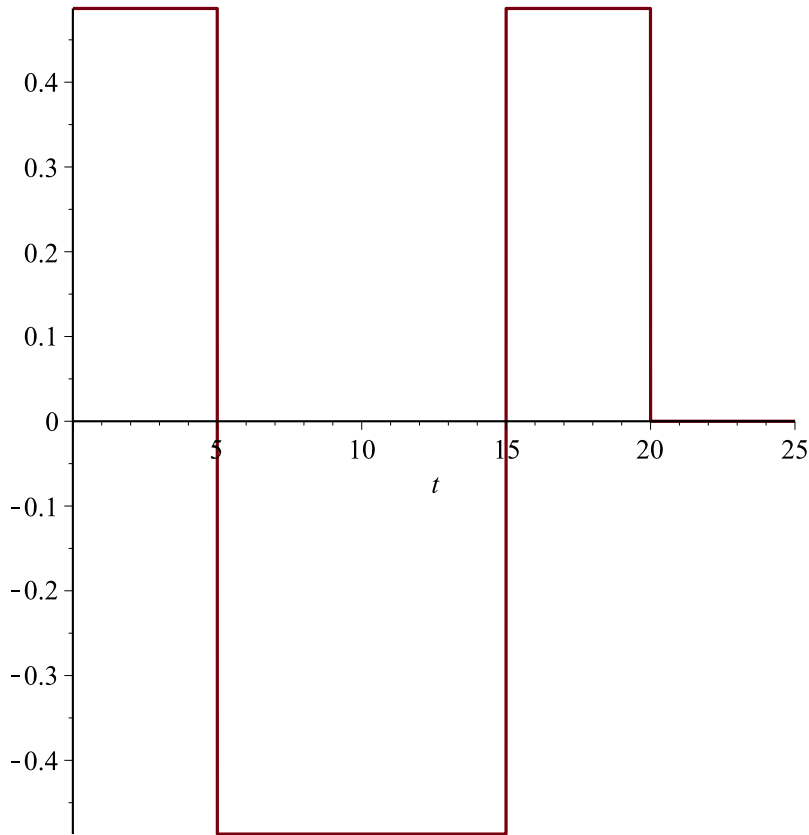
> $Ecua := diff(y(t), t\$3) = Sac$

$$Ecua := \frac{d^3}{dt^3} y(t) = \frac{487}{1000} \text{Heaviside}(t) - \frac{487}{500} \text{Heaviside}(t-a) + \frac{487}{500} \text{Heaviside}(t-3a) \qquad (13)$$

$$- \frac{487}{1000} \text{Heaviside}(t-4a)$$

> $CondIni := y(0) = 0, D(y)(0) = 0, D(D(y))(0) = 0$

$$CondIni := y(0) = 0, D(y)(0) = 0, D^{(2)}(y)(0) = 0 \qquad (14)$$

> $with(inttrans):$

> $EcuaTL := subs(CondIni, laplace(Ecua, t, s))$

$$EcuaTL := s^3 \, laplace(y(t), t, s) = \frac{487}{1000 \, s} - \frac{487}{500} \, laplace(\text{Heaviside}(t-a), t, s) \qquad (15)$$

$$+ \frac{487}{500} \, laplace(\text{Heaviside}(t-3a), t, s) - \frac{487}{1000} \, laplace(\text{Heaviside}(t-4a), t, s)$$

> $SolTL := isolate(EcuaTL, laplace(y(t), t, s))$

$$SolTL := laplace(y(t), t, s) = \frac{1}{s^3} \left(\frac{487}{1000 \, s} - \frac{487}{500} \, laplace(\text{Heaviside}(t-a), t, s) \right) \qquad (16)$$

$$+ \frac{487}{500} \, laplace(\text{Heaviside}(t - 3\,a), t, s) - \frac{487}{1000} \, laplace(\text{Heaviside}(t - 4\,a), t, s) \Bigg)$$

> $SolPart := invlaplace(SolTL, s, t)$

$$SolPart := y(t) = \frac{487}{6000} \, t^3 - \frac{487}{500} \, \text{Heaviside}(-a)\, a^3 - \frac{487}{6000} \, \text{Heaviside}(t - 4\,a)\,(t - 4\,a)^3 \tag{17}$$

$$+ \frac{487}{3000} \, \text{Heaviside}(t - 3\,a)\,(t - 3\,a)^3 - \frac{487}{3000} \, \text{Heaviside}(t - a)\,(t - a)^3$$

> $y(4\,a) = 225$

$$y(4\,a) = 225 \tag{18}$$

> $SolDos := subs(t = 4\,a, rhs(SolPart) = 225)$

$$SolDos := \frac{1948}{375} \, a^3 - \frac{487}{500} \, \text{Heaviside}(-a)\, a^3 + \frac{487}{3000} \, \text{Heaviside}(a)\, a^3 \tag{19}$$

$$- \frac{4383}{1000} \, \text{Heaviside}(3\,a)\, a^3 = 225$$

> $SolTres := subs(\text{Heaviside}(-a) = 0, \text{Heaviside}(a) = 1, \text{Heaviside}(3\,a) = 1, SolDos)$

$$SolTres := \frac{487}{500} \, a^3 = 225 \tag{20}$$

> $Tiempo := solve(SolTres) : evalf(\%)$

$$6.135846980, \; -3.067923491 + 5.313799364\,\text{I}, \; -3.067923491 - 5.313799364\,\text{I} \tag{21}$$

> $Tiempo[1]$

$$\frac{5}{487} \, 14610^{2/3} \tag{22}$$

> $restart$

> $Castillo := 5 \cdot \text{Heaviside}(t - 2) + (t - 2) \cdot \text{Heaviside}(t - 2) - 2(t - 3) \cdot \text{Heaviside}(t - 3) + (t - 4) \cdot \text{Heaviside}(t - 4) - 2 \cdot \text{Heaviside}(t - 4) + (t - 6) \cdot \text{Heaviside}(t - 6) - 2 \cdot (t - 7) \cdot \text{Heaviside}(t - 7) + (t - 8) \cdot \text{Heaviside}(t - 8) + 2 \cdot \text{Heaviside}(t - 10) + (t - 10) \cdot \text{Heaviside}(t - 10) - 2 \cdot (t - 11) \cdot \text{Heaviside}(t - 11) + (t - 12)\text{Heaviside}(t - 12) - 5 \cdot \text{Heaviside}(t - 12); Puerta := 2 \cdot \text{Heaviside}(t - 6) - 2 \cdot \text{Heaviside}(t - 8); plot(\{Castillo, Puerta\}, t = 0 .. 15, y = 0 .. 10)$

$$Castillo := 5\,\text{Heaviside}(t - 2) + (t - 2)\,\text{Heaviside}(t - 2) - 2\,(t - 3)\,\text{Heaviside}(t - 3) + (t - 4)\,\text{Heaviside}(t - 4) - 2\,\text{Heaviside}(t - 4) + (t - 6)\,\text{Heaviside}(t - 6) - 2\,(t - 7)\,\text{Heaviside}(t - 7) + (t - 8)\,\text{Heaviside}(t - 8) + 2\,\text{Heaviside}(t - 10) + (t - 10)\,\text{Heaviside}(t - 10) - 2\,(t - 11)\,\text{Heaviside}(t - 11) + (t - 12)\,\text{Heaviside}(t - 12) - 5\,\text{Heaviside}(t - 12)$$

$$Puerta := 2\,\text{Heaviside}(t - 6) - 2\,\text{Heaviside}(t - 8)$$