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> restart
FENÓMENO DE LA RESONANCIA
> Ecuacion := diff(x(t), t$2) + 16·x(t) = 150·sin(4 t)
      Ecuacion :=  $\frac{d^2}{dt^2} x(t) + 16 x(t) = 150 \sin(4 t)$  (1)
> Condiciones := x(0) = 0, D(x)(0) = 0
      Condiciones :=  $x(0) = 0, D(x)(0) = 0$  (2)
> EcuaHom := lhs(Ecuacion) = 0
      EcuaHom :=  $\frac{d^2}{dt^2} x(t) + 16 x(t) = 0$  (3)
> Q := rhs(Ecuacion)
      Q :=  $150 \sin(4 t)$  (4)
> EcuaCarac := m·2 + 16 = 0
      EcuaCarac :=  $m^2 + 16 = 0$  (5)
> Raiz := solve(EcuaCarac)
      Raiz :=  $4 I, -4 I$  (6)
> SolUno := x(t) = cos(Im(Raiz1)·t)
      SolUno :=  $x(t) = \cos(4 t)$  (7)
> SolDos := x(t) = sin(Im(Raiz1)·t)
      SolDos :=  $x(t) = \sin(4 t)$  (8)
> SolHom := x(t) = C1·rhs(SolUno) + C2·rhs(SolDos)
      SolHom :=  $x(t) = C_1 \cos(4 t) + C_2 \sin(4 t)$  (9)
> SolNoHom := x(t) = A·rhs(SolUno) + B·rhs(SolDos)
      SolNoHom :=  $x(t) = A \cos(4 t) + B \sin(4 t)$  (10)
> with(linalg) :
> WW := wronskian([rhs(SolUno), rhs(SolDos)], t)
      WW :=  $\begin{bmatrix} \cos(4 t) & \sin(4 t) \\ -4 \sin(4 t) & 4 \cos(4 t) \end{bmatrix}$  (11)
> BB := array([0, Q])
      BB :=  $\begin{bmatrix} 0 & 150 \sin(4 t) \end{bmatrix}$  (12)
> PRIMA := simplify(linsolve(WW, BB))
      PRIMA :=  $\begin{bmatrix} -\frac{75}{2} \sin(4 t)^2 & \frac{75}{2} \cos(4 t) \sin(4 t) \end{bmatrix}$  (13)
> A := int(PRIMA1, t) + C1; B := int(PRIMA2, t) + C2
      A :=  $\frac{75}{16} \cos(4 t) \sin(4 t) - \frac{75}{4} t + C_1$ 
      B :=  $-\frac{75}{16} \cos(4 t)^2 + C_2$  (14)
> SolNoHom
      SolNoHom (15)

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$$x(t) = \left(\frac{75}{16} \cos(4t) \sin(4t) - \frac{75}{4} t + C_1 \right) \cos(4t) + \left(-\frac{75}{16} \cos(4t)^2 + C_2 \right) \sin(4t) \quad (15)$$

> Sistema := subs(t=0, rhs(SolNoHom)) = rhs(Condiciones₁), subs(t=0,
rhs(diff(SolNoHom, t))) = rhs(Condiciones₂) : Sistema₁; Sistema₂
 $C_1 = 0$

$$-\frac{75}{4} + 4C_2 = 0 \quad (16)$$

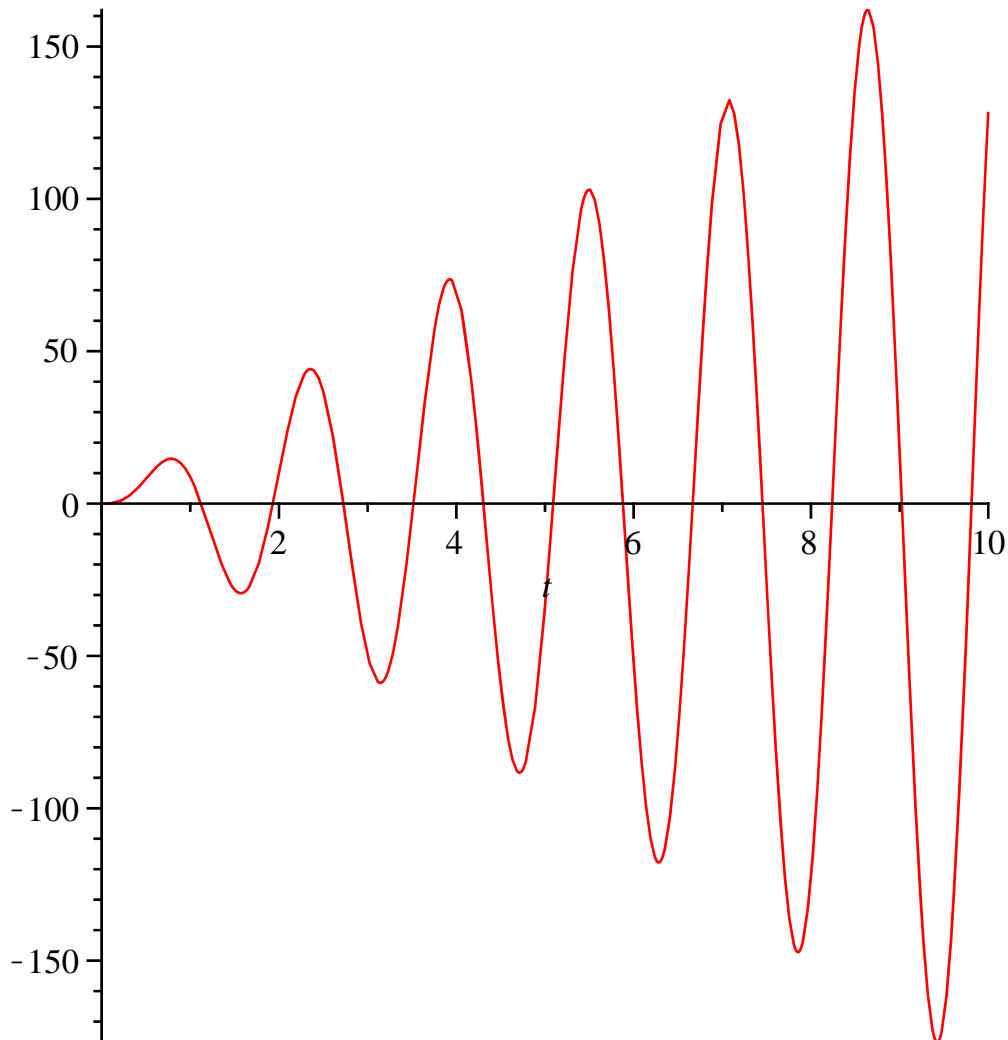
> Parametro := solve({Sistema}, {C₁, C₂})

$$Parametro := \left\{ C_1 = 0, C_2 = \frac{75}{16} \right\} \quad (17)$$

> SolPart := subs(C₁ = rhs(Parametro₁), C₂ = rhs(Parametro₂), SolNoHom)

$$SolPart := x(t) = \left(\frac{75}{16} \cos(4t) \sin(4t) - \frac{75}{4} t \right) \cos(4t) + \left(-\frac{75}{16} \cos(4t)^2 + \frac{75}{16} \right) \sin(4t) \quad (18)$$

> plot(rhs(SolPart), t=0..10)



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