

> restart

>

POR dsolve

> Sistema := diff(x1(t), t\$2) = $\frac{H_2}{M_1} \cdot (x_2(t) - x_1(t)) - \frac{H_1}{M_1} \cdot x_1(t)$, diff(x2(t), t\$2) = $-\frac{H_2}{M_2} \cdot (x_2(t) - x_1(t))$: Sistema1; Sistema2

$$\frac{d^2}{dt^2} x_1(t) = \frac{H_2 (x_2(t) - x_1(t))}{M_1} - \frac{H_1 x_1(t)}{M_1}$$
$$\frac{d^2}{dt^2} x_2(t) = -\frac{H_2 (x_2(t) - x_1(t))}{M_2} \quad (1)$$

> M1 := 2; M2 := 1; H1 := 2; H2 := 1

$$M_1 := 2$$

$$M_2 := 1$$

$$H_1 := 2$$

$$H_2 := 1 \quad (2)$$

> Sistema1; Sistema2

$$\frac{d^2}{dt^2} x_1(t) = \frac{1}{2} x_2(t) - \frac{3}{2} x_1(t)$$

$$\frac{d^2}{dt^2} x_2(t) = -x_2(t) + x_1(t) \quad (3)$$

> Condiciones := x2(0) = $\frac{1}{10}$, x1(0) = $\frac{H_1}{H_2} \cdot \frac{1}{10}$, D(x1)(0) = 0, D(x2)(0) = 0

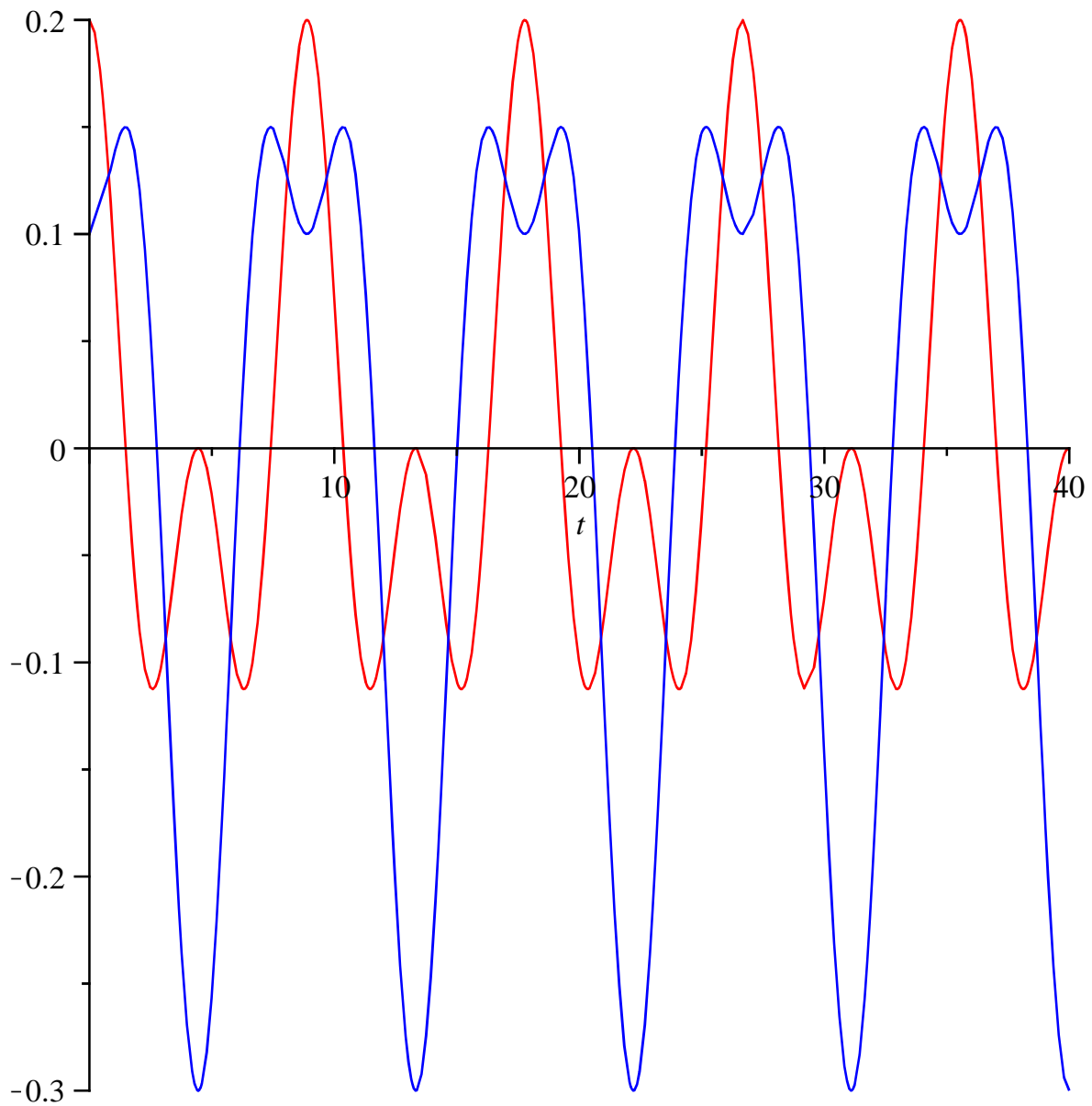
$$Condiciones := x_2(0) = \frac{1}{10}, x_1(0) = \frac{1}{5}, D(x_1)(0) = 0, D(x_2)(0) = 0 \quad (4)$$

> Solucion := dsolve({Sistema, Condiciones}) : Solucion1; Solucion2

$$x_1(t) = \frac{1}{10} \cos\left(\frac{1}{2} \sqrt{2} t\right) + \frac{1}{10} \cos(\sqrt{2} t)$$

$$x_2(t) = \frac{1}{5} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{1}{10} \cos(\sqrt{2} t) \quad (5)$$

> plot([rhs(Solucion1), rhs(Solucion2)], t = 0..40, color = [red, blue])



>

POR MATRIZ EXPONENCIAL

> $AA := array\left(\left[\begin{bmatrix} 0 & 0 & 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 & 0 & 1 \end{bmatrix}, \begin{bmatrix} -\frac{(H_2 + H_1)}{M_1}, \frac{H_2}{M_1}, 0, 0 \end{bmatrix}, \begin{bmatrix} \frac{H_2}{M_2}, -\frac{H_2}{M_2}, 0, 0 \end{bmatrix}\right]\right)$

$$AA := \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -\frac{3}{2} & \frac{1}{2} & 0 & 0 \\ 1 & -1 & 0 & 0 \end{bmatrix}$$

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> $Xcero := array\left(\left[\begin{bmatrix} \frac{H_1}{H_2} \cdot \frac{1}{10}, \frac{1}{10}, 0, 0 \end{bmatrix}\right]\right)$

$$X_{cero} := \begin{bmatrix} \frac{1}{5} & \frac{1}{10} & 0 & 0 \end{bmatrix} \quad (7)$$

> with(linalg) :

> MatExp := exponential(AA, t) :

> MatExp[1, 1]; MatExp[1, 2]; MatExp[1, 3]; MatExp[1, 4]; MatExp[2, 1]; MatExp[2, 2];
MatExp[2, 3]; MatExp[2, 4]; MatExp[3, 1]; MatExp[3, 2]; MatExp[3, 3]; MatExp[3, 4];
MatExp[4, 1]; MatExp[4, 2]; MatExp[4, 3]; MatExp[4, 3];

$$\begin{aligned} & \frac{2}{3} \cos(\sqrt{2} t) + \frac{1}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) \\ & \frac{1}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{1}{3} \cos(\sqrt{2} t) \\ & \frac{1}{3} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} + \frac{1}{3} \sin(\sqrt{2} t) \sqrt{2} \\ & \frac{1}{3} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} - \frac{1}{6} \sin(\sqrt{2} t) \sqrt{2} \\ & \frac{2}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{2}{3} \cos(\sqrt{2} t) \\ & \frac{1}{3} \cos(\sqrt{2} t) + \frac{2}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) \\ & \frac{2}{3} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} - \frac{1}{3} \sin(\sqrt{2} t) \sqrt{2} \\ & \frac{2}{3} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} + \frac{1}{6} \sin(\sqrt{2} t) \sqrt{2} \\ & - \frac{2}{3} \sin(\sqrt{2} t) \sqrt{2} - \frac{1}{6} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} \\ & - \frac{1}{6} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} + \frac{1}{3} \sin(\sqrt{2} t) \sqrt{2} \\ & \frac{2}{3} \cos(\sqrt{2} t) + \frac{1}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) \\ & \frac{1}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{1}{3} \cos(\sqrt{2} t) \\ & \frac{2}{3} \sin(\sqrt{2} t) \sqrt{2} - \frac{1}{3} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} \\ & - \frac{1}{3} \sin\left(\frac{1}{2} \sqrt{2} t\right) \sqrt{2} - \frac{1}{3} \sin(\sqrt{2} t) \sqrt{2} \\ & \frac{2}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{2}{3} \cos(\sqrt{2} t) \\ & \frac{2}{3} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{2}{3} \cos(\sqrt{2} t) \end{aligned} \quad (8)$$

> SOLUCION := evalm(MatExp &* Xcero) : SOLUCION₁; SOLUCION₂

$$\frac{1}{10} \cos\left(\frac{1}{2} \sqrt{2} t\right) + \frac{1}{10} \cos(\sqrt{2} t)$$

(9)

$$\frac{1}{5} \cos\left(\frac{1}{2} \sqrt{2} t\right) - \frac{1}{10} \cos(\sqrt{2} t)$$

(9)

> plot([SOLUCION₁, SOLUCION₂], t = 0 .. 40, color = [red, blue])

