1 (PVI)

$$\begin{cases} y'(t) = f(t, y(t)) \leftarrow \forall t \\ y(t_0) = y_0 \leftarrow \text{condiciones iniciales} \end{cases}$$

$f(t, y(t))$ ← define la ecuación diferencial

incógnita: la función $y(t)$ que cumple las ecuaciones

datos: f, t_0, y_0

En general $y : \mathbb{R} \to \mathbb{R}^n$ $\quad y(t) = \begin{pmatrix} y_1(t) \\ \vdots \\ y_n(t) \end{pmatrix}$ $\quad y_0 \in \mathbb{R}^n$

$t_0 \in \mathbb{R}$ $\quad y(t) \in \mathbb{R}^n$ $\quad t \in \mathbb{R}$ $\quad y'(t) \in \mathbb{R}^n$

$f : \mathbb{R} \times \mathbb{R}^n \to \mathbb{R}^n$

$f(t, y(t))$

$$x(t) = \begin{pmatrix} x_1(t) \\ x_2(t) \end{pmatrix} \qquad \boxed{\begin{aligned} x_1(t) &= y(t) \\ x_2(t) &= y'(t) \end{aligned}} \quad (x'(t) = F(t, x(t)))$$

$$\begin{cases} y'' - 3y' + 5y \overset{*}{=} \cos(t) \\ y(0) = 0 \\ y'(0) = 1 \end{cases}$$

$t_0 = 0$

la ecuación se traduce a $x' = F(t, x)$

$$x'(t) = \begin{pmatrix} x_1'(t) \\ x_2'(t) \end{pmatrix} \overset{*}{=} \begin{pmatrix} y'(t) \\ y''(t) \end{pmatrix} \overset{*}{=} \begin{pmatrix} y' \\ 3y' - 5y + \cos(t) \end{pmatrix} \overset{*}{=} \begin{pmatrix} x_2 \\ 3x_2 - 5x_1 + \cos(t) \end{pmatrix}$$

$$\Rightarrow x' = F(t, x) \quad \text{con} \quad F(t, (x_1, x_2)) = \begin{pmatrix} x_2 \\ 3x_2 - 5x_1 + \cos(t) \end{pmatrix} \quad F: \mathbb{R} \times \mathbb{R}^2 \to \mathbb{R}^2$$

cond. inicial $\quad x(0) = \begin{pmatrix} x_1(0) \\ x_2(0) \end{pmatrix} = \begin{pmatrix} y(0) \\ y'(0) \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

$$\begin{cases} x' = F(t, x) \\ x(0) = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \end{cases} \quad \text{PVI}$$

Resolvemos y $y(t) = x_1(t)$

(9) $y' = F(t, y)$

$$y = \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} \qquad \begin{aligned} y_1(t) &= c(t) \\ y_2(t) &= z(t) \end{aligned}$$

$$y' = \begin{pmatrix} y_1' \\ y_2' \end{pmatrix} = \begin{pmatrix} 2y_1 - \alpha y_1 y_2 \\ -y_2 + \alpha y_1 y_2 \end{pmatrix} = F(t, y)$$

$$y(0) = \begin{pmatrix} c_0 \\ z_0 \end{pmatrix}$$

no se usa

[tiempos, poblaciones] = ode23 (F, [0 10], y_0)

$$t_{tiempos} = [t_0, t_1, t_2, \sim, t_{71}]$$

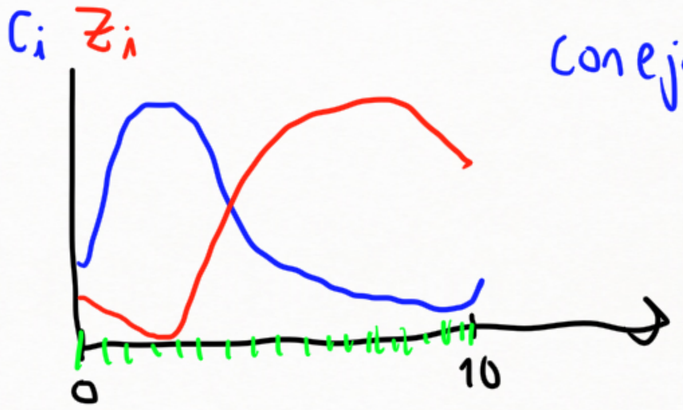
$t_0 = 0$, $t_{71} = 10$

plot(t, p[:,1])

conejos en función de t

zorros en función de t

plot(t, p[:,2])



$$poblaciones = \begin{pmatrix} c_0 & z_0 \\ c_1 & z_1 \\ \vdots & \vdots \\ c_{71} & z_{71} \end{pmatrix}$$

$c(t_0)$ ss $z(t_0)$

$c(t_1)$ $\approx$ $z(t_1)$

$c(t_{71})$ $\approx$ $z(t_{71})$

$$(c_i, z_i) \approx y(t_i)$$

$$F\left(\frac{1}{\alpha}, \frac{2}{\alpha}\right) = \begin{pmatrix} 2\cdot\frac{1}{\alpha} - \alpha\cdot\frac{1}{\alpha}\cdot\frac{2}{\alpha} \\ -\frac{2}{\alpha} + \alpha\cdot\frac{1}{\alpha}\cdot\frac{2}{\alpha} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\mathcal{C}(t) = \frac{1}{\alpha}$$

$$z(t) = \frac{2}{\alpha}$$

$$\Rightarrow \begin{pmatrix} \mathcal{C}'(t) \\ z'(t) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} u' \\ v' \end{pmatrix} = \begin{pmatrix} \mathcal{C}' \\ z' \end{pmatrix} = \begin{pmatrix} 2\left(u+\frac{1}{\alpha}\right) & -\alpha\left(u+\frac{1}{\alpha}\right)\left(v+\frac{2}{\alpha}\right) \\ -\left(v+\frac{2}{\alpha}\right) & +\alpha\left(u+\frac{1}{\alpha}\right)\left(v+\frac{2}{\alpha}\right) \end{pmatrix}$$

$$u = \mathcal{C} - \frac{1}{\alpha}$$

$$v = z - \frac{2}{\alpha}$$

$$= \begin{pmatrix} -v & -\alpha u v \\ 2u & +\alpha u v \end{pmatrix}$$

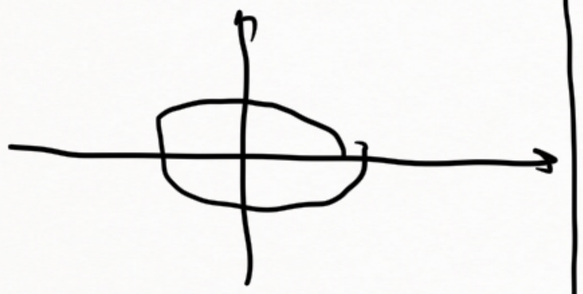
desp

$$\begin{cases} u' = -v \\ v' = 2u \end{cases}$$

$$u(t) = A\cos(\sqrt{2}t) + B\operatorname{sen}(\sqrt{2}t)$$

$$v(t) = C\cos(\sqrt{2}t) + D\operatorname{sen}(\sqrt{2}t)$$

↳ $u'' = -2u \qquad v'' = -2v$



$$\sqrt{2}T = 2\pi$$

$$\downarrow$$

$$T = \frac{2\pi}{\sqrt{2}}$$