

$$y = C_1 e^{-x} + C_2 x e^{-x}$$

$$\underline{m_1 = -1 \quad m_2 = -1}$$

tipo  $\textcircled{\text{II}}$  raíces iguales y reales

$$(m+1)(m+1) = 0$$

$$(m+1)^2 = 0$$

$$\underline{m^2 + 2m + 1 = 0}$$

$$(\mathcal{D}^2 + 2\mathcal{D} + 1)y = 0$$

$$\underline{\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + y = 0}$$

$$y = C_1 e^{2x} \cos(3x) + C_2 e^{2x} \sin(3x) + \\ + C_3 x e^{2x} \cos(3x) + C_4 x e^{2x} \sin(3x)$$

$$(m - 2 - 3i)^2 (m - 2 + 3i)^2 = 0$$

$$m_1 = 2 + 3i \quad m_3 = 2 + 3i$$

$$m_2 = 2 - 3i \quad m_4 = 2 - 3i$$

$$((m-2) - 3i)^2 ((m-2) + 3i)^2 = 0$$

$$((m-2)^2 - 6(m-2)i - 9)((m-2)^2 + 6(m-2)i - 9) = 0$$

$$(m-2)^4 + \cancel{6(m-2)^3 i} - 9(m-2)^2 - \cancel{6(m-2)^3 i} + 36(m-2)^2 + \\ + \cancel{54(m-2)i} - 9(m-2)^2 - \cancel{54(m-2)i} + 81 = 0$$

$$(m-2)^4 + 18(m-2)^2 + 81 = 0$$

$$m^4 - 8m^3 + 24m^2 - 32m + 16 +$$

$$+ 18m^2 - 72m + 72 + 81 = 0$$

$$m^4 - 8m^3 + 42m^2 - 104m + 109 = 0$$

$$\begin{array}{cccc} & & 1 & \\ & & 1 & 1 \\ & 1 & 2 & 1 \\ 1 & 3 & 3 & 1 \\ 1 & 4 & 6 & 4 & 1 \end{array}$$

$$y = C_1 \cos(4x) + C_2 \operatorname{sen}(4x)$$

$$m_1 = 4i \quad m_2 = -4i$$

$$a \in \mathbb{R}$$

$$b \in \mathbb{R}^+$$

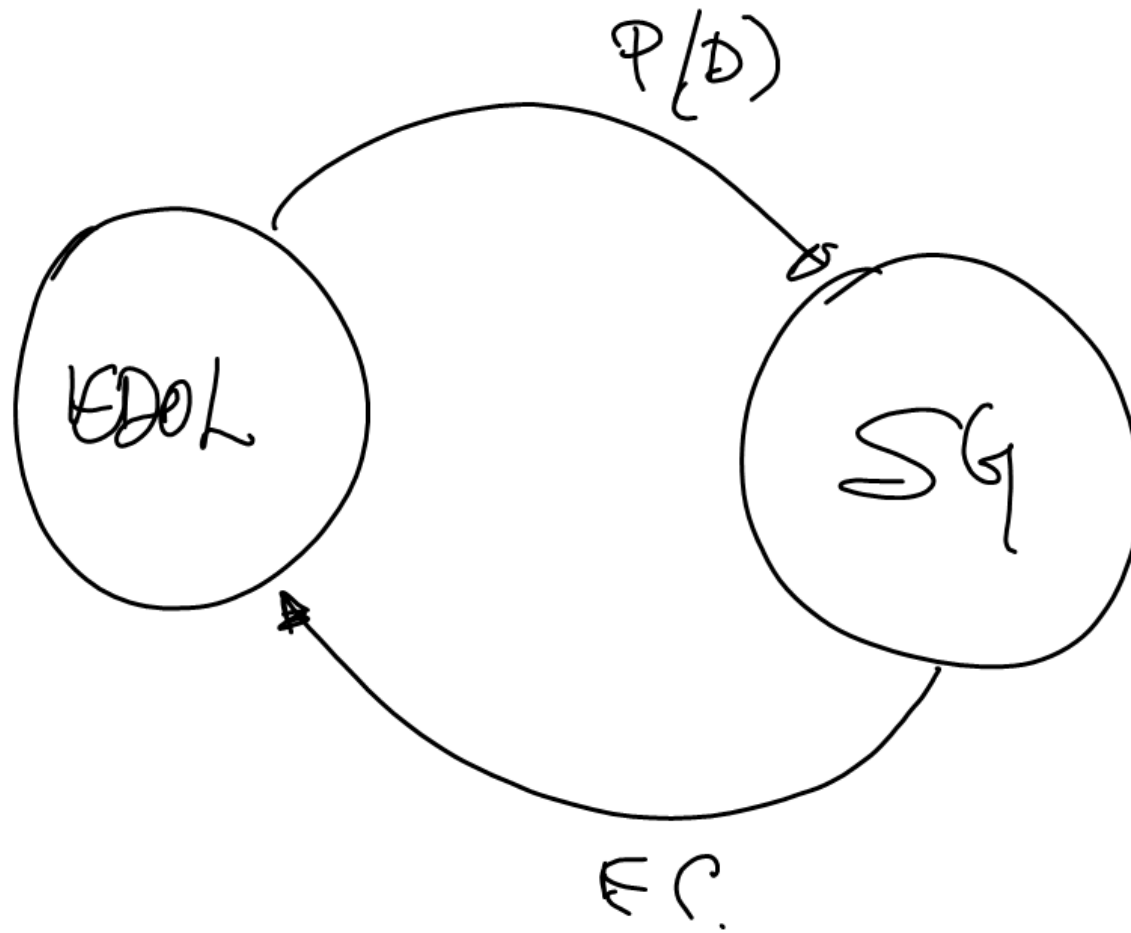
$$(m - 4i)(m + 4i) = 0$$

$$a \pm bi$$

$$m^2 + 4i - 4i + 16 = 0$$

$$(m - a - bi)(m - a + bi) \quad m^2 + 16 = 0$$

$$\left( \frac{d^2 y}{dx^2} + 16y \right) = 0$$



$$y = C_1 e^{-4x} + C_2 x e^{-4x} + C_3 e^x$$

$$(m+4)^2(m-1) = 0 \quad \text{EDEL (3) cc A.}$$

$$(m^2 + 8m + 16)(m-1) = 0$$

$$m^3 + 7m^2 + 8m - 16 = 0$$

$$(\mathcal{D}^3 + 7\mathcal{D}^2 + 8\mathcal{D} - 16)y = 0$$

$$\frac{d^3 y}{dx^3} + 7 \frac{d^2 y}{dx^2} + 8 \frac{dy}{dx} - 16y = 0$$

EDOL(2) cc NH

$$\frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 6y = 4e^{-3x}$$

$$\begin{aligned} (D^2 - 5D + 6)y &= 0 \\ (D-2)(D-3)y &= 0 \\ \downarrow \text{g/H} \\ y &= c_1 e^{2x} + c_2 e^{3x} \end{aligned}$$

MÉTODO DEL OPERADOR DIFERENCIAL.

$$(D-2)(D-3)y = 4e^{-3x} \quad \text{EDOL(2) cc NH}$$

$$(D+3)(D-2)(D-3)y = 0 \quad \text{EDOL(3) cc H}$$

$$\begin{aligned} y_{\text{g/H}_1} &= c_1 e^{-3x} + \cancel{c_2 e^{2x}} + \cancel{c_3 e^{3x}} \\ -y_{\text{g/H}_2} &= \cancel{c_1 e^{2x}} + \cancel{c_2 e^{3x}} \\ y_{\text{p/g}} &= A e^{-3x} \end{aligned}$$

$$y_{\text{g/NH}} = y_{\text{g/H}_1} + y_{\text{p/g}}$$

$$\begin{aligned} y &= A e^{-3x} \\ \frac{dy}{dx} &= -3A e^{-3x} \\ \frac{d^2 y}{dx^2} &= 9A e^{-3x} \end{aligned} \quad \left\{ \begin{aligned} (9A e^{-3x}) - 5(-3A e^{-3x}) + 6(A e^{-3x}) &= 4e^{-3x} \\ (9+15+6)A e^{-3x} &= 4e^{-3x} \\ 30A e^{-3x} &= 4e^{-3x} \end{aligned} \right.$$

$$30A = 4$$

$$A = \frac{4}{30} \Rightarrow \frac{2}{15}$$

$$y_{\text{g/NH}} = c_1 e^{2x} + c_2 e^{3x} + \frac{2}{15} e^{-3x}$$

$$\frac{d^2 y}{dx^2} + 6 \frac{dy}{dx} + 8y = 12e^{-2x}$$

$$(D^2 + 6D + 8)y = 0$$

$$(D+2)(D+4)y = 0$$

$$y_{g/h} = C_1 e^{-2x} + C_2 e^{-4x}$$

$$(D+2)(D+4)y = 12e^{-2x}$$

$$(D+2)(D+2)(D+4)y = 0$$

$$(D+2)^2(D+4)y = 0$$

$$y = C_1 e^{-2x} + C_2 x e^{-2x} + C_3 e^{-4x}$$

$$y = C_1 e^{-2x} + C_2 e^{-4x}$$

$$y_p = A x e^{-2x}$$

$$\frac{dy}{dx} = -2A x e^{-2x} + A e^{-2x}$$

$$\frac{d^2 y}{dx^2} = 4A x e^{-2x} - 2A e^{-2x} - 2A e^{-2x}$$

$$= 4A x e^{-2x} - 4A e^{-2x}$$

$$(4A x e^{-2x} - 4A e^{-2x}) + 6(-2A x e^{-2x} + A e^{-2x}) +$$

$$+ 8(A x e^{-2x}) = 12e^{-2x}$$

$$(4A - 12A + 8A)x e^{-2x} + (-4A + 6A)e^{-2x} = 12e^{-2x}$$

$$(0)x e^{-2x} + (2A)e^{-2x} = 12e^{-2x}$$

$$2A = 12$$

$$A = 6$$

$$y = C_1 e^{-2x} + C_2 e^{-4x} + 6x e^{-2x}$$