Clasificación EDO

EDO
- Primer Orden
  - NO LINEALES I
  - LINEALES
- Orden superior
  - LINEALES
  - NO-LINEALES X

II III IV

EDenDP V

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$$

E.D.O.L.(2)

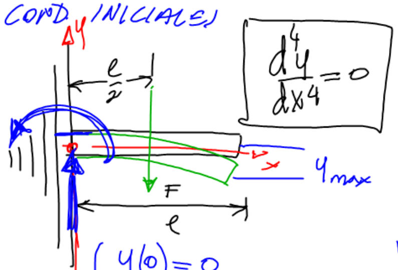
$$\begin{cases} y(0) \\ y'(0) \end{cases}$$

$$y_g = c_1 y_1 + c_2 y_2$$

$$W \Rightarrow \begin{vmatrix} y_1 & y_2 \\ y_1' & y_2' \end{vmatrix} \neq 0$$

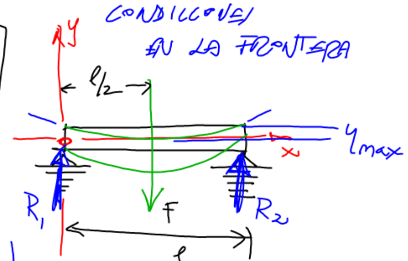
y_p

COND. INICIALES



$$\frac{d^4y}{dx^4}=0$$

CONDICIONES EN LA FRONTERA



$$\begin{cases} y(0)=0 \\ y'(0)=0 \\ y''(0)=F \\ y'''(0)=-F\cdot\frac{l}{2} \end{cases}$$

$$\begin{cases} y(0)=0 \\ y''(0)=\frac{F}{2} \end{cases} \qquad y(l)=0 \qquad y''(l)=\frac{F}{2}$$

$$\frac{d^4y}{dx^4}=0 \rightarrow \frac{d}{dx}\left(\frac{d^3y}{dx^3}\right)=0 \qquad \frac{d^3y}{dx^3}=k_1 \qquad \frac{d}{dx}\left(\frac{d^2y}{dx^2}\right)=k_1$$

$$d\left(\frac{d^2y}{dx^2}\right)=(k_1)dx \qquad \int d\left(\frac{d^2y}{dx^2}\right)=k_1\int dx$$

$$\frac{d^2y}{dx^2}+k_2=k_1(x+k_3) \qquad \frac{d^2y}{dx^2}=k_1x+(k_1k_3-k_2)$$

$$\frac{d^2y}{dx^2}=k_1x+C_2 \qquad \frac{d}{dx}\left(\frac{dy}{dx}\right)=k_1x+C_2$$

$$d\left(\frac{dy}{dx}\right)=(k_1x+C_2)dx \qquad \int d\left(\frac{dy}{dx}\right)=k_1\int x\,dx+C_2\int dx$$

$$\frac{dy}{dx}+k_4=\frac{k_1}{2}x^2+C_2x+k_5+k_6$$

$$\frac{dy}{dx}=C_1x^2+C_2x+C_3 \qquad dy=(C_1x^2+C_2x+C_3)dx$$

$$\int dy=C_1\int x^2dx+C_2\int x\,dx+C_3\int dx$$

$$y+k_7=C_1\left(\frac{x^3}{3}+k_8\right)+C_2\left(\frac{x^2}{2}+k_9\right)+C_3(x+k_{10})$$

$$y=\frac{C_1}{3}x^3+\frac{C_2}{2}x^2+C_3x+(C_1k_8+C_2k_9+C_3k_{10}-k_7)$$

$$\boxed{y=C_1x^3+C_2x^2+C_3x+C_4}$$

Orden → cuántos prámetros o constantes arbitraria tiene → condiciones

ED

Sol. GRAL.

↓

y_p

¿LINEAL o NO LINEAL? EDO

EDO(n) $F\left(x, y(x), \frac{dy}{dx}, \frac{d^2y}{dx^2}, \dots\right) = 0$

$$FF\left(x, y, \frac{dy}{dx}, \dots\right) = Q(x)$$

$$x^2\frac{d^2y}{dx^2} - \frac{\frac{dy}{dx}}{x} + \log(x)\, y - 6\cos(3x) + 8e^{2x} = 0 \leftarrow L$$

$$\underbrace{x^2\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} + \log(x)\, y}_{FF} = \underbrace{6\cos(3x) - 8e^{2x}}_{Q(x)}$$

Si FF es lineal en "y" entonces toda EDO es LINEAL.

$$FF\left(x, \lambda y, \frac{d}{dx}\lambda y, \dots\right) \Rightarrow \lambda^n FF\left(x, y, \frac{dy}{dx}, \dots\right)$$

$$x^2\frac{d^2}{dx^2}\lambda y - \frac{1}{x}\frac{d}{dx}\lambda y + \log(x)(\lambda y) \Rightarrow \lambda x^2\frac{d^2y}{dx^2} - \frac{\lambda}{x}\frac{dy}{dx} + \lambda\log(x)\, y$$

$$\Rightarrow \lambda\left(x^2\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} + \log(x)\, y\right)$$

NO-LINEALES

1er caso: cuando y ó sus derivadas tengan exponente distinto de "1"

$$\frac{dy}{dx} + y^3 = 0$$

$$\left.\left(\frac{dy}{dx}\right)^2 + y^3 = 0 \right\} \quad GRADO = 2$$

2º cuando y y sus derivadas se multipliquen entre sí

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

3º cuando y sea argumento de funciones intrascendentes

$$\frac{d^2\theta}{dt^2} + \omega \operatorname{sen}(\theta) = 0 \qquad \theta(t)$$

$$\frac{dy}{dx} + e^y$$

$$a_0(x)\frac{d^n y}{dx^n} + a_1(x)\frac{d^{n-1} y}{dx^{n-1}} + \dots \dots + a_{n-1}(x)\frac{dy}{dx} + a_n(x)y = Q(x)$$

FORMA GENERAL EDO(n)L.

¡¡ninguna NO-LINEAL entra!!