Método del Operador Diferencial.

EDO(n)L.

$\ddot{y} = -g$

$$\left.\begin{array}{ll} \frac{dy}{dx} & \text{Leibnitz.} \\ y' & \\ \dot{y} & \text{Newton} \\ D_x y & \text{O.D.} \end{array}\right\} \text{Derivada}$$

$$Dy \longrightarrow \frac{dy}{dt} \longrightarrow \frac{dy}{dx}$$

$$D(Dy) \Leftrightarrow D^2 y$$

$$D(D^n y) \Leftrightarrow D^{n+1} y$$

$$D^{-1}(y) \quad \rightarrow D(D^{-1} y) = y$$

$$\int y \, dx = D^{-1} y + C_1$$

$$D^2y + a_1 Dy + a_2 y = 0$$

$$(D^2 + a_1 D + a_2)\,y = 0$$

$$m^2 + a_1 m + a_2 = 0 \quad E(A)C.$$

$$(m-a)(m-b) = 0$$

$$m_1 = a \qquad m_2 = b$$

$$(D-a)(D-b)\,y = 0$$

$$y_g = c_1 e^{ax} + c_2 e^{bx}$$

$$(D-a)(D-b)\left[c_1 e^{ax} + c_2 e^{bx}\right] = 0$$

$$\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0$$

$$D^2y - 7Dy + 12y = 0$$

$$(D^2 - 7D + 12)y = 0$$

$$(D-4)(D-3)y = 0$$

$$y_g = c_1e^{4x} + c_2e^{3x}$$

$$(D-4)(D-3)\left[c_1e^{4x} + c_2e^{3x}\right] = 0$$

$$(D-4)\left[4c_1e^{4x} + 3\cancel{c_2}e^{3x} - 3c_1e^{4x} - 3\cancel{c_2}e^{3x}\right] = 0$$

$$(D-4)\left[c_1e^{4x}\right] = 0$$

$$4\cancel{c_1}e^{4x} - 4\cancel{c_1}e^{4x} = 0$$

$$0 = 0$$

$$(D-5)^2(D-4)y=0$$

$$(D^2-10D+25)(D-4)y=0$$

$$(D^3-10D^2+25D-4D^2+40D-100)y=0$$

$$(D^3-14D^2+65D-100)y=0$$

$$\frac{d^3y}{dx^3}-14\frac{d^2y}{dx^2}+65\frac{dy}{dx}-100y=0$$

$$y_g=C_1e^{5x}+C_2xe^{5x}+C_3e^{4x}$$

CASO II CASO I.

$$(D-5)^2(D-4)y=0$$

$$(D^2+4)(D+\sqrt{2})y=0$$

$$(D^3+\sqrt{2}D^2+4D+4\sqrt{2})y=0$$

$$y_g=C_1\cos(2x)+C_2\operatorname{sen}(2x)+C_3e^{-\sqrt{2}x}$$

EDO(n)Lcc NH.

$$P(D)y = Q(x) \qquad P(D)y = 0$$

$$y_{g/NH} = y_{g/H} + y_{p/Q}.$$

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

$$(D^2 - 4D + 3)y = 5e^{5x}$$

$$(D^2 - 4D + 3)y = 0$$

$$y_{g/NH} = y_{g/H} + y_{p/Q}$$

$$\boxed{\begin{array}{l}(D-3)(D-1)y = 0 \\ y_{g/H} = C_1e^{3x} + C_2e^{x}\end{array}}$$

NH $\quad (D-3)(D-1)y = 5e^{5x}$

$P(D)y$	$y(x)$
$(D-m)$ $(D-m)^2$ $(D-m)^3$ $(D-m)^{n+1}$	e^{mx} xe^{mx} x^2e^{mx} $\vdots$ x^ne^{mx}
D D^2 D^{n+1}	c_1 c_1x c_1x^n
(D^2+b^2) $(D^2+b^2)^2$ $(D^2+b^2)^{n+1}$	$\cos(bx)$ $\operatorname{sen}(bx)$ $x\cos(bx)$ $x\operatorname{sen}(bx)$ $x^n\cos(bx)$ $x^n\operatorname{sen}(bx)$
$((D-a)^2+b^2)$ $((D-a)^2+b^2)^2$ $((D-a)^2+b^2)^{n+1}$	$e^{ax}\cos(bx)$ $e^{ax}\operatorname{sen}(bx)$ $xe^{ax}\cos(bx)$ $xe^{ax}\operatorname{sen}(bx)$ $x^ne^{ax}\cos(bx)$ $x^ne^{ax}\operatorname{sen}(bx)$

$$(D-3)(D-1)y = 5e^{5x}$$ EDO(2)Lcc NH.

$$(D-3)(D-1)\underset{A}{(D-5)}y = 0$$

$$y_g = C_1e^{3x} + C_2e^{x} + C_3e^{5x}$$ EDO(3)Lcc H.

$$y_{g/H.} \qquad y_{p/Q}$$

$$y_g = C_1e^{3x} + C_2e^{x} + Ae^{5x}$$ COEFICIENTE INDETERMINADO

$$y_{p/Q} = Ae^{5x}$$

$$\frac{dy}{dx} = 5Ae^{5x}$$

$$\frac{d^2y}{dx^2} = 25Ae^{5x}$$

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

$$(25Ae^{5x}) - 4(5Ae^{5x}) + 3(Ae^{5x}) = 5e^{5x}$$

$$(25A - 20A + 3A)e^{5x} = 5e^{5x}$$

$$8Ae^{5x} = 5e^{5x}$$

$$8A = 5$$

$$A = \frac{5}{8}$$

$$\boxed{y_g = c_1e^{3x} + c_2e^{x} + \frac{5}{8}e^{5x}}$$

$$y'' - 4y' + 3y = 5e^{5x}$$

$$\frac{d^2y}{dx^2}+2\frac{dy}{dx}+2y=2e^x+x^2+\cos(2x)$$

$$\boxed{\begin{gathered}(D^2+2D+2)y=0\\ ((D+1)^2+(1)^2)y=0\\ y_{g_H}=C_1e^{-x}\cos(x)+C_2e^{-x}\mathrm{sen}(x)\end{gathered}}$$

EDO(2) NH $((D+1)^2+(1)^2)y=2e^x+x^2+\cos(2x)$

EDO(8) H. $((D+1)^2+(1)^2)(D-1)_A D^3_A (D^2+4)_A y=0$

$$y_g=C_1e^{-x}\cos(x)+C_2e^{-x}\mathrm{sen}(x)+C_3e^x+C_4x^2+C_5x+C_6+C_7\cos(2x)+C_8\mathrm{sen}(2x)$$

$$y_{p/a}=Ae^x+Bx^2+Dx+E+F\cos(2x)+G\,\mathrm{sen}(2x)$$