ENG 361

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COMPUTER ENGINEERING

18/ENG/02 1016

④ $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 4$

$m^2 - m - 2 = 0 \quad m_1 = 2, \; m_2 = -1$

$y = Ae^{2x} + Be^{-x}$

$P_1 : y = c$

$\frac{dy}{dx} = 0, \quad \frac{d^2y}{dx^2} = 0$

$0 - 0 - 2c = 4$

$-2c = 4$

$c = \frac{-4}{2}$

$c = -4$

$P_1 : y = -4$

G.S: $y = Ae^{2x} + Be^{-x} - 4$

⑤ $\frac{d^2y}{dx^2} - 4y = 10e^{3x}$

$m^2 - 4 = 0$

$m^2 = 4$

$m = \pm\sqrt{4}$

$m = \pm 2j$

$y = c(\cosh 2x + D\sinh 2x)$

$P_1 : y = 2e^{3x}$

$\frac{dy}{dx} = 3ce^{3x}$

$\frac{d^2y}{dx^2} = 9ce^{3x}$

$9ce^{3x} = 4(ce^{3x}) - 10e^{3x}$

$5ce^{3x} = 10e^{3x}$

$c = \frac{10e^{3x}}{3e^{3x}} \qquad c = 2$

G.S = $c(\cosh 2x + D\sinh e^{2x} + 2e^{3x})$

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

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

$\frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times 1}}{2 \times 1} = \frac{-2}{2} = -1$

$m = -1$

$y = e^{-x}(A + Bx)$

P.I : $y = Ce^{-2x}$

$\frac{dy}{dx} = -2Ce^{-2x}$

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

$4Ce^{-2x} - 2(2Ce^{-2x}) + Ce^{-2x} = e^{-2x}$

$C = 1$

$y = e^{-2x}$

G.S = $y = e^{-x}(A + Bx) + e^{-2x}$

④ $\frac{d^2y}{dx^2} + 25y = 5x^2 + x$

$m^2 + 25 = 0$

$m^2 = -25$

$m = \pm\sqrt{25}$

$m = \pm 5j$

$y = C\cos 5x + D\sin 5x$

P.I : $y = Cx^2 + Dx + E$

$\frac{dy}{dx} = 2Cx + D$

$\frac{d^2y}{dx^2} = 2C$

$2C + 25(Cx^2 + Dx + E) = 5x^2 + x$

$25C = 5$ comparing coefficients $C = 1/5$

$25D = 1 \therefore D = 1/25$

$25E + 2C = 0$

$25E + 2(1/5) = 0$

$25E = -2/5 \; ; \; E = -2/125$

$y = 1/5x^2 + 1/25x - 2/125$

G.S = $y = C\cos 5x + D\sin 5x + 1/5x^2 + 1/25x - 2/125$

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

$m^2 - 2m + 1$

$\frac{2 \pm \sqrt{(-2)^2 - 4 \times 1 \times 1}}{2 \times 1} \Rightarrow 2/2 = 1$

$m = 1$

$y = e^x (A + Bx)$

$dy/dx = -C\sin x + D\cos x$

$\frac{d^2y}{dx^2} = C\cos x - D\sin x$

$-C\cos x - D\sin x - 2(-C\sin x + D\cos x) + C\cos x + D\sin x = 4\sin x$

$-C\cos x - D\sin x + 2C\sin x - 2D\cos x + C\cos x + D\sin x = 4\sin x$

$-2D\cos x + 2C\sin x = 4\sin x$

comparing coefficients

$-2D = 0 \qquad 2C = 4$

$D = -0/2 \qquad C = 4/2$

$D = 0 \qquad C = 2$

$y = 2\cos x + 0\sin x$

$y = 2\cos x$

G.S $= y = e^x(A + Bx)$

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

$m^2 + 4m + 5$

$y = e^{-2x}(\cos 2x + D\sin 2x)$

$P_1 : y = Ce^{-2x}$

$\frac{dy}{dx} = -2Ce^{-2x}$

$d^2y/dx = 4Ce^{-2x}$

$4Ce^{-2x} + 4(-2Ce^{-2x}) + 5(Ce^{-2x}) = 2e^{-2x}$

$4Ce^{-2x} - 8Ce^{-2x} + 5Ce^{-2x} = 2e^{-2x}$

$4C + 5C - 8C = 2$

$C = 2$, $y = 2e^{-2x}$

G.S : $y = e^{-2x}\{(\cos 2x + D\sin 2x) + 2e^{-2x}$

when $x = 0$

$y = e^{-2(0)}(C(\cos 2(0) + D\sin 2(0))) + 2e^{-2(0)}$

$1 = C + 2 \quad ; \quad C = -1$

$\frac{dy}{dx} = e^{-2x}(-2\sin 2x + 2D\cos 2x) + (C(\cos 2x + D\sin 2x))(-2e^{-2x})$

at $x = 0$

$D = -1$

G.S : $y = e^{-2x}(C(\cos 2x - D\sin 2x)$

(7) $3\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - y = 2x - 3$

$3m^2 - 2m - 1 = 0$

$m = \frac{2 \pm \sqrt{(-2)^2 - 4 \times 3 \times -1}}{2 \times 3} = \frac{2 \pm \sqrt{4 + 12}}{6}$

$= \frac{2 \pm \sqrt{16}}{6}$

$= \frac{2 + 4}{6}$ or $\frac{2 - 4}{6}$

$= 1$ or $-1/3$

$m_1 = 1$; $m_2 = -1/3$

$y = Ae^x + Be^{-x/3}$

P.I : $y = Cx + D$

$\frac{dy}{dx} = C$

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

$3(0) - 2(Cx + D) = 2x - 3$

$\Rightarrow -Cx - D = 2x - 3$

comparing coefficients

$C = -2$

$-2C - D = -3$

$-2(-2) - D = -3$

$4 - D = -3$

$D = 4 + 3 = 7$

$y = -2x + 7$

G.S $\Rightarrow y = Ae^x + Be^{-1/3} - 2x + 7$

(8) $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 4y = 8e^{4x}$

$m^2 - 6m + 4 = 0$

$m_{1,2} = \frac{4 \pm 2}{2}$

$y = Ae^{4x} + Be^{2x} = e^{4x}$

PI: $y = cxe^{4x}$

$\frac{dy}{dx} = 4(cxe^{4x}) + ce^{4x}$

$\frac{d^2y}{dx} = 16cxe^{4x} + 8ce^{4x}$

$16cxe^{4x} + 8ce^{4x} - 6(4cxe^{4x} + ce^{4x}) + 4(cxe^{4x})$

$16cx + 8c - 24cx - 6c + 8cx = 8$

$2c = 8$

$c = 4$

$y = 4xe^{4x}$

Gen: $y = Ae^{4x} + 8e^{2x} + 4xe^{4x}$