OKAFOR JUDE-THADDEUS
15/ENG02/040
COMPUTER ENG ~~ENG381~~.

ASSIGNMENT 2

(i) $\frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 6\sin\theta$

$m^2 + 4m + 5 = 0$

$m = -i \pm j$

$y = C\cos\theta + D\sin\theta$

$\frac{dy}{d\theta} = -C\sin\theta + D\cos\theta$

$\frac{d^2y}{d\theta^2} = -\cos\theta - D\sin\theta$

$-C\cos\theta - D\sin\theta + 4(-C\sin\theta + D\cos\theta) + 5(C\cos\theta + D\sin\theta) = 6\sin\theta$

$-C\cos\theta - D\sin\theta - 4C\sin\theta + 4D\cos\theta + 5C\cos\theta + 5D\sin\theta = 6\sin\theta$

$4C\cos\theta + 4D\sin\theta - 4C\sin\theta + 4D\cos\theta = 6\sin\theta$

$4C + 4D = 0$

$4C = -4D$

$C = -D$

from eqn 1

$C = -\frac{3}{4}$

$4D - 4C = 6$

$4D - 4(-D) = 6$

$4D + 4D = 6$

$8D = 6$

$D = \frac{3}{4}$ —— (1)

$$\therefore y = \frac{-3}{4}\cos\theta + \frac{3}{4}\sin\theta$$

$$y = \frac{3}{4}\left(-\cos\theta + \sin\theta\right)$$

C.F :

$$y = e^{-2\theta}(A\cos\theta + B\sin\theta) + \frac{3}{4}(-\cos\theta + \sin\theta)$$

(iii) $$y = e^{-2\theta}(A\cos\theta + B\sin\theta) - \frac{3}{4}\cos\theta + \frac{3}{4}\sin\theta$$

At steady state $\theta = \infty$; $\frac{dy}{d\theta} = 0$

$$\frac{dy}{d\theta} = \frac{d}{d\theta}(y)$$

$$u = e^{-2\theta}$$

$$\frac{du}{d\theta} = -2e^{-2\theta}$$

$$v = A\cos\theta + B\sin\theta$$

$$\frac{dv}{d\theta} = -A\sin\theta + B\cos\theta$$

$$\frac{dy}{d\theta} = e^{-2\theta}(A\sin\theta + B\cos\theta) + (A\cos\theta + B\sin\theta) - 2e^{-2\theta}$$

$$\frac{dy}{d\theta} = e^{-2t}(-A\sin\theta + B\cos\theta) + (A\cos\theta + B\sin\theta) - 2e^{-2\theta} + \frac{3}{4}\sin\theta + \frac{3}{4}\cos\theta$$

$$\theta = \infty \quad \frac{dy}{d\theta} = 0$$

$0 = \frac{3}{4}\sin\theta + \frac{3}{4}\cos\theta$

divide through by $\cos\theta$

$0 = \frac{3}{4}\tan + \frac{3}{4}$

$\frac{-3}{4} = \frac{3}{4}\tan\theta = -12 = 4(3\tan\theta)$

$\frac{-12}{4} = \frac{4(3\tan\theta)}{4}$

$-3 = \frac{3\tan\theta}{3}$

$-1 = \tan\theta$

$\theta = \tan^{-1}(-1)$

$\theta = -45^\circ$