Tutorial Sheet 7 – Nyquist & Bode Plots

Q1 By converting to polar format, simplify the following expressions. Write your answer in both polar and cartesian form.

$$\text{(i) } \frac{1+2j}{2-j} \qquad\qquad \text{(ii) } \frac{j(1-3j)}{(3-2j)(5+4j)}$$

Q2 Sketch the Nyquist diagram for each of the following systems:

$$\text{(i) } G(s) = \frac{k}{(s+1)(s+2)} \qquad\qquad \text{(ii) } G(s) = \frac{k(s+3)}{(s+1)(s+2)}$$

Q3 Sketch the Nyquist diagram for a system with the following OLTF:

$$G(s) = \frac{27k}{(s+3)^3}$$

Q4 (i) Sketch the Nyquist diagram for the following system when k = 10, 40 and 100:

$$G(s) = \frac{k}{(s+1)(s+2)(s+3)}$$

(ii) Show that the Nyquist plot crosses the negative real axis at a frequency of $\omega = \sqrt{11}$

(iii) Show that $|G(j\omega)| = 1$ when $\omega = 1$, ≈ 2.73 and ≈ 4.14 for $k = 10$, 40 and 100 respectively.

Q5 Repeat Q2 using Bode Plots instead of the Nyquist Diagram.

Q6 Repeat Q3 using Bode Plots instead of the Nyquist Diagram.

Q7 (i) Sketch the Bode diagram for the following system when k = 10, 40 and 100:

$$G(s) = \frac{k}{(s+1)(s+2)(s+3)}$$