

EE3114 HW4

4-1

a) $D(s) = s^3 + 2s^2 + 2s + 3$

$$s^3 \quad 1 \quad 2$$

$$s^2 \quad 2 \quad 3$$

$$s^1 \quad \frac{1}{2} \quad 0$$

$$s^0 \quad 3$$

There is no sign change in first column. The system is stable.

b) $D(s) = s^4 + s^3 + s^2 + s + 3$

$$s^4 \quad \quad \quad 1 \quad \quad \quad 1 \quad \quad \quad 3$$

$$s^3 \quad \quad \quad 1 \quad \quad \quad 1 \quad \quad \quad 0$$

$$s^2 \quad \quad \quad \varepsilon (\varepsilon > 0) \quad \quad \quad 3 \quad \quad \quad 0$$

$$s^1 \quad \quad \quad \frac{\varepsilon - 3}{\varepsilon} < 0 \quad \quad \quad 0$$

$$s^0 \quad \quad \quad 3$$

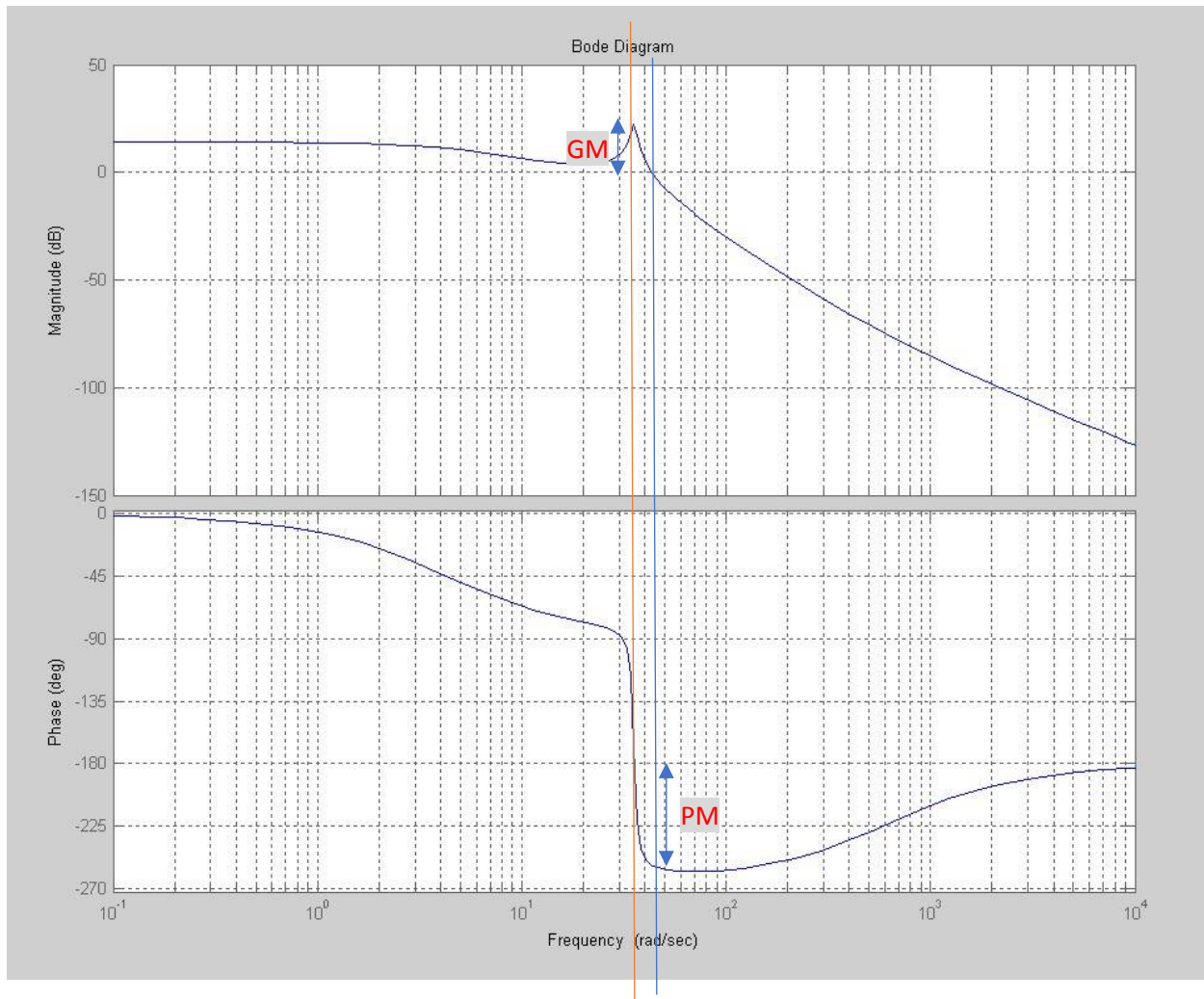
There is sign change in first column. The system is unstable.

Marking:

(1) Right Ruth criterion (10'+10')

(2) Right conclusion (5')

4-2 Given a Bode plot from MatLab as follows, determine the system Magnitude Margin and Phase Margin:



$$GM \approx 0 - 25 = -25 \text{ dB}$$

$$PM \approx -255^\circ - (-180^\circ) = -75^\circ$$

The close values are also right.

Marking:

(1) Right mythology (15')

(2) Right region (10')

4-3 The system with $G(s)H(s) = \frac{2}{s(2s-1)}$ has a Nyquist plot as follows. Determine whether the corresponding closed-loop system is stable or not.

(1) $G(s)H(s)$ has 1 pole in RHP. (P=1)

(2) $\lim_{s \rightarrow \infty} G(s)H(s) = 0$ is constant

Point $-1+0j$ is not encircled by curve counterclockwise once (P=1, N=1 $\Rightarrow N+P \neq 0$). The closed loop system is unstable.

Marking:

(1) Right mythology (15')

(2) Right N and P and conclusion (10')

4-4 The system with $G(s)H(s) = \frac{10(s+1)}{s(s-10)}$ has a Nyquist plot as follows. Determine whether the corresponding closed-loop system is stable or not.

(1) $G(s)H(s)$ has 1 pole in RHP. (P=1)

(2) $\lim_{s \rightarrow \infty} G(s)H(s) = 0$ is constant

Point $-1+0j$ is not encircled by curve counterclockwise once (P=1, N=1 $\Rightarrow N+P \neq 0$). The closed loop system is unstable.

Marking:

(1) Right mythology (15')

(2) Right N and P and conclusion (10')