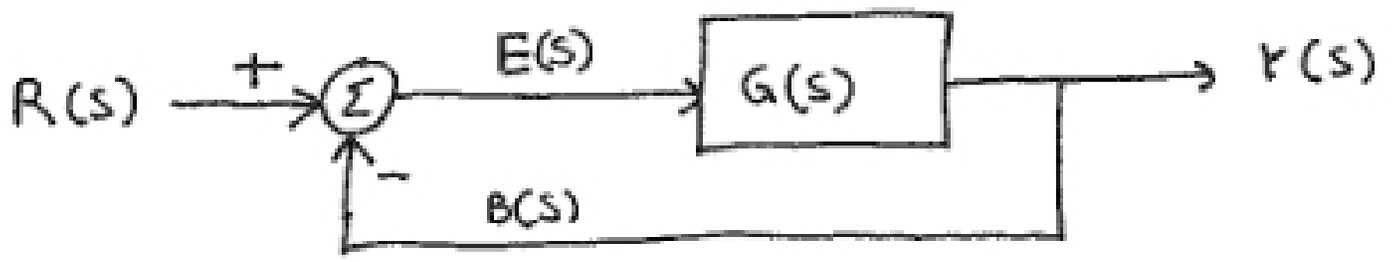
Determining GM and PM from the Polar Plot

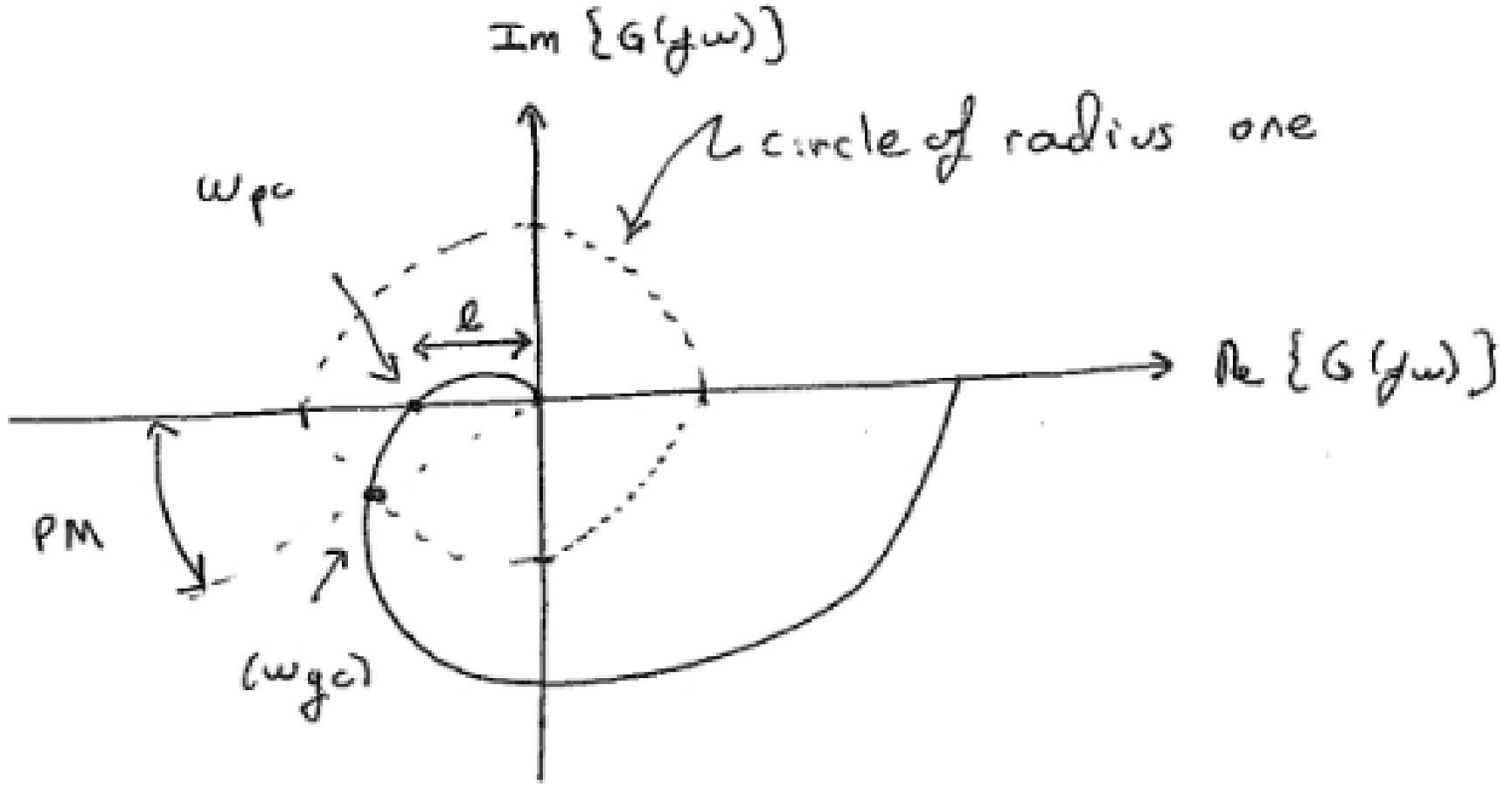
Consider the closed-loop system



with the open-loop transfer function

$$\frac{E(s)}{B(s)} = G(s).$$

we can determine the GM and PM directly from the polar plot.



$$GM = 20 \log_{10} \frac{1}{\ell}$$

Example

Suppose

$$G(s) = \frac{10}{s(s/10 + 1)(s/100 + 1)}$$

From the Bode magnitude and phase plots on L 32.3

$GM = 20.8$ dB $\qquad \omega_{pc} = 31.6$ rad/sec

$PM = 47.4°$ $\qquad \omega_{gc} = 7.8$ rad/sec

We can also obtain the same results from the polar plots on L 32.3 and L 32.4

The m-file is on page L 32.6

Bode Plot of $G(s) = \dfrac{10}{s(s/10+1)(s/100+1)}$