Phase and Gain Stability Margins

Two important notions can be derived from the Nyquist diagram: *phase and gain stability margins*. The phase and gain stability margins are presented in Figure 4.8.

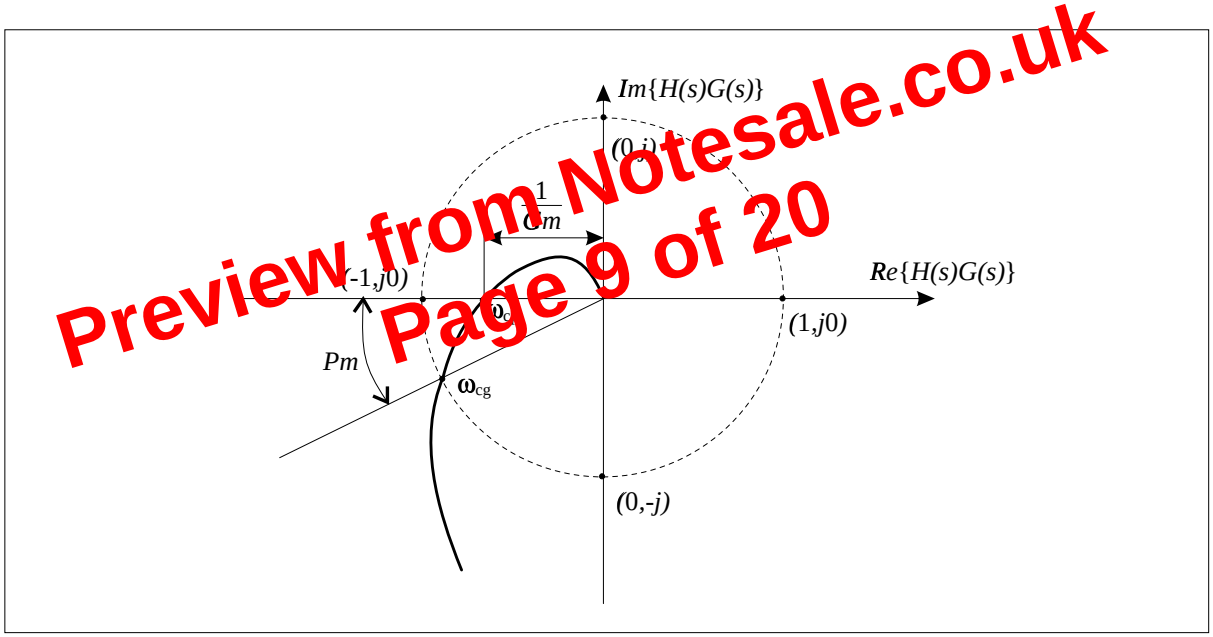

Figure 4.8: Phase and gain stability margins

From these expressions we see that neither the real nor the imaginary parts can be made zero, and hence the Nyquist plot has no points of intersection with the coordinate axis. For $\omega = 0^+$ we are at point B and since the plot at $\omega = +\infty$ will end up at the origin, the Nyquist diagram corresponding to part (c) has the form as shown in Figure 4.9. Note that the vertical asymptote of the Nyquist plot in Figure 4.9 is given by $Re\{G(j0^{\pm})H(j0^{\pm})\} = -1$ since at those points $Im\{G(j0^{\pm})H(j0^{\pm})\} = \mp\infty$.

From the Nyquist diagram we see that $N = 0$ and since there are no open-loop poles in the left half of the complex plane, i.e. $P = 0$, we have $Z = 0$ so that the corresponding closed-loop system has no unstable poles.