

Appendix W6.9.2

The Inverse Nyquist Diagram

The **inverse Nyquist plot** is simply the reciprocal of the Nyquist plot described in Section 6.3 and used in Section 6.4 for the definition and discussion of stability margins. It is obtained most easily by computing the inverse of the magnitude from the Bode plot and plotting that quantity at an angle in the complex plane, as indicated by the phase from the Bode plot. It can be used to find the PM and GM in the same way that the Nyquist plot was used. When $|G(j\omega)| = 1$, $|G^{-1}(j\omega)| = 1$ also, so the definition of PM is identical on the two plots. However, when the phase is -180° or $+180^\circ$, the value of $|G^{-1}(j\omega)|$ is the GM directly; no calculation of an inverse is required, as was the case for the Nyquist plot.

The inverse Nyquist plot for the system in Fig. 6.24 (see Example 6.9) is shown in Fig. W6.7 for the case where $K = 1$ and the system is stable. Note $GM = 2$ and $PM \cong 20^\circ$. As an example of a more complex case, Fig. W6.8 shows an inverse Nyquist plot for the sixth-order case whose Nyquist plot was shown in Fig. 6.41, and whose Nichols chart was shown in Fig. 6.83. Note here $GM = 1.2$ and $PM \cong 35^\circ$. Had the two crossings of the unit circle not occurred at the same point, the crossing with the smallest PM would have been the appropriate one to use.

Figure W6.7
Inverse Nyquist plot for
Example 6.9

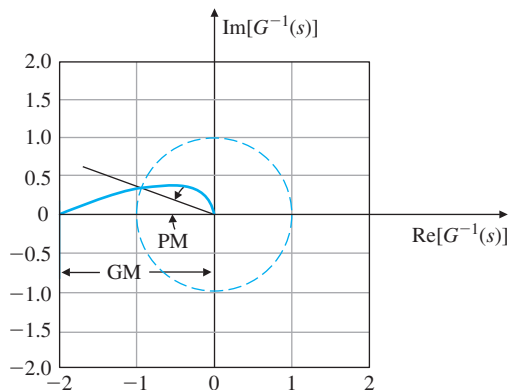


Figure W6.8

Inverse Nyquist plot of the system whose Nyquist plot is in Fig. 6.41

