

Concept Question 6-9: Why do we need poles in a notch filter? Why not just use zeros only?

Rejecting the frequencies $\omega \pm \omega_0$ could indeed be accomplished by zeros at $s = \pm j\omega_0$, but such a filter would also reject frequencies near $\omega \pm \omega_0$; it would not be selective. Using poles at $s = a \pm j\omega_0$ in addition to zeros at $s = \pm j\omega_0$ makes the filter pass frequencies that are not near $\omega \pm \omega_0$ without reducing them. The poles effectively cancel the zeros, except near $\omega \pm \omega_0$. See Fig. 6-27 for an example of this.

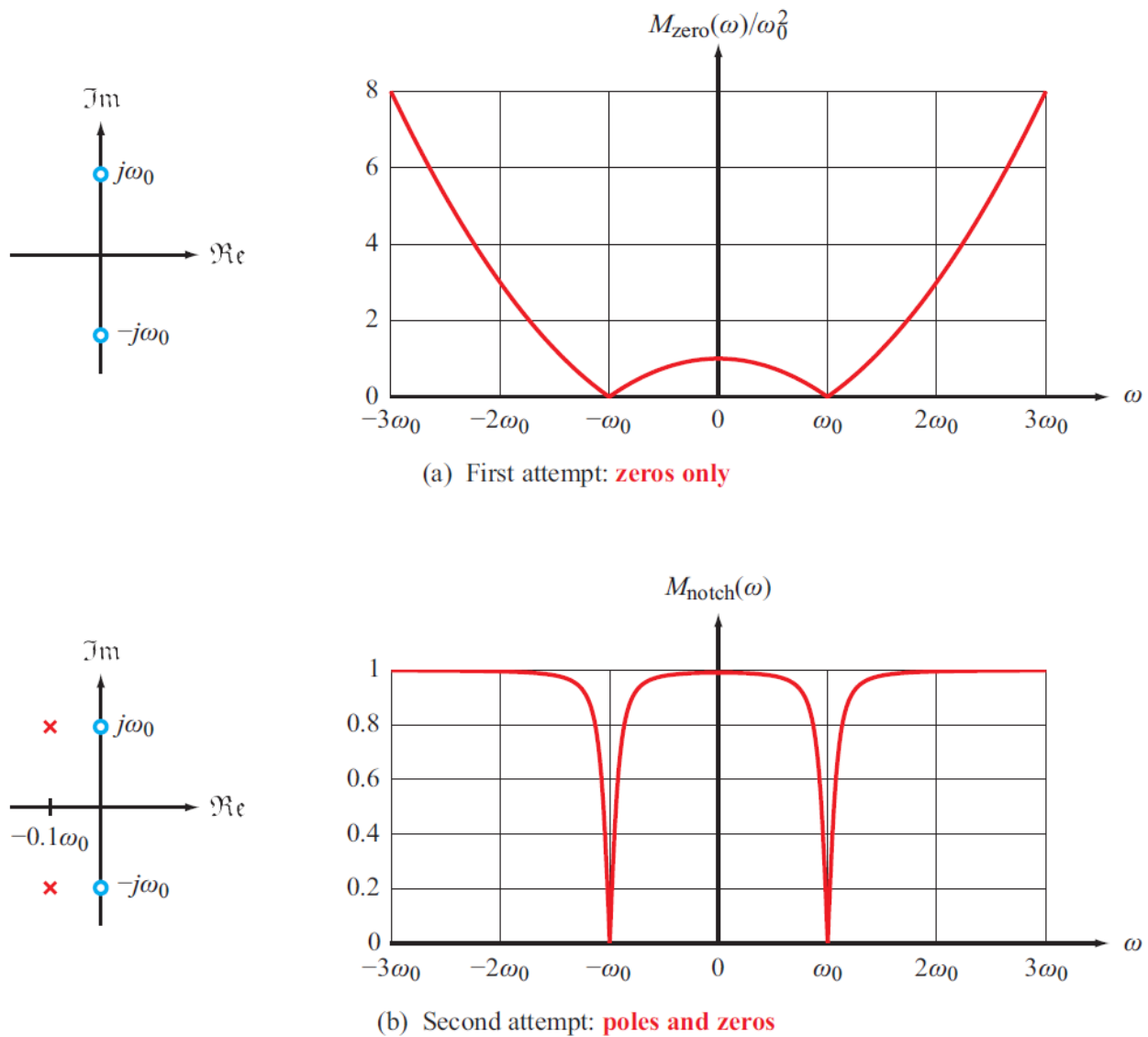


Figure 6-27: Two attempts at designing a filter to reject $\omega_0 = \pm 120\pi$ (rad/s); i.e., $f_0 = 60$ Hz.