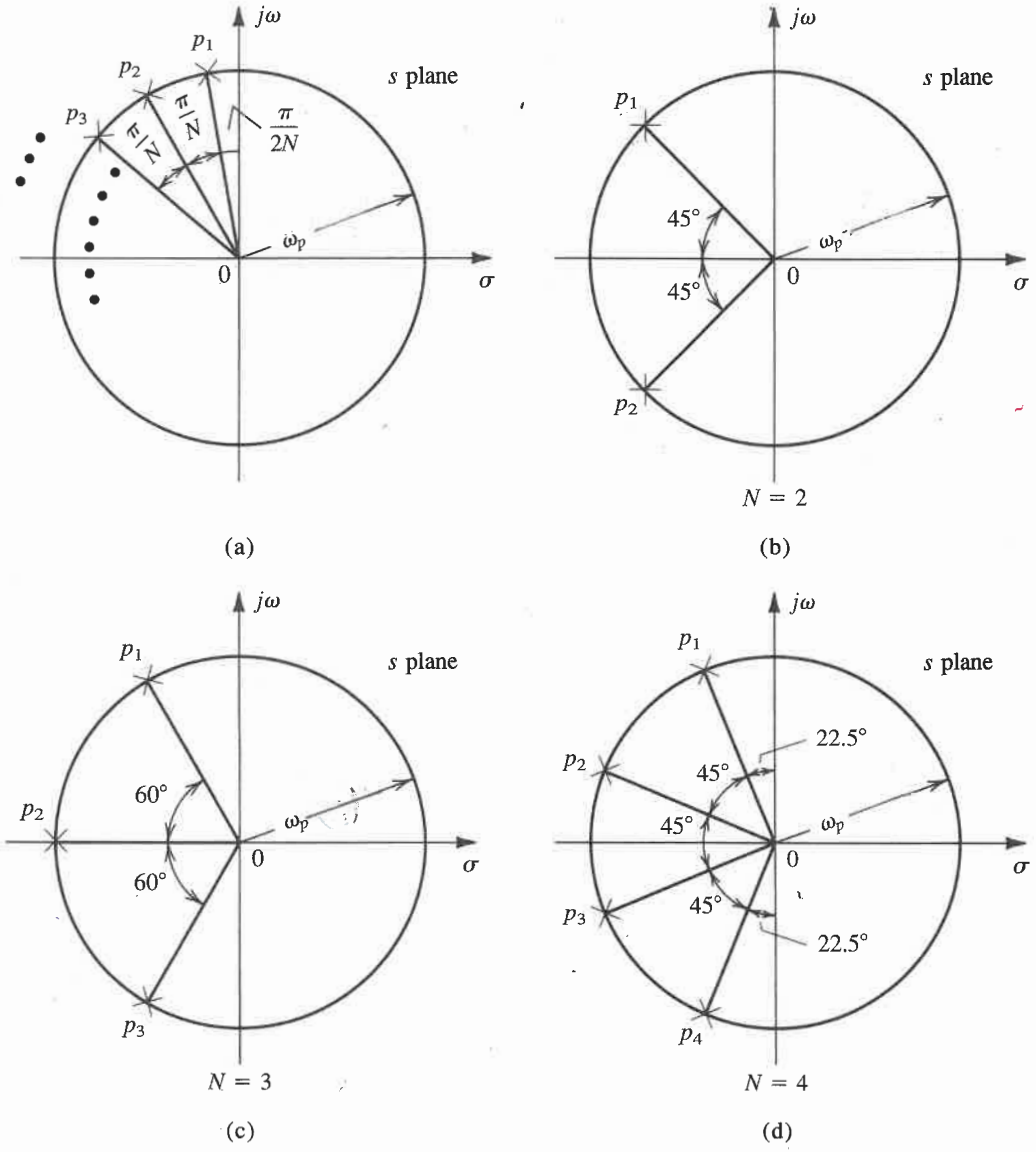

Fig. 11.10 Graphical construction for determining the poles of a Butterworth filter of order N. All the poles lie in the left half of the s-plane on a circle of radius $\omega_0 = \omega_p(1/\epsilon)^{1/N}$, where ϵ is the passband deviation parameter ($\epsilon = \sqrt{10^{A_{max}/10} - 1}$): **(a)** the general case, **(b)** $N = 2$, **(c)** $N = 3$, **(d)** $N = 4$.