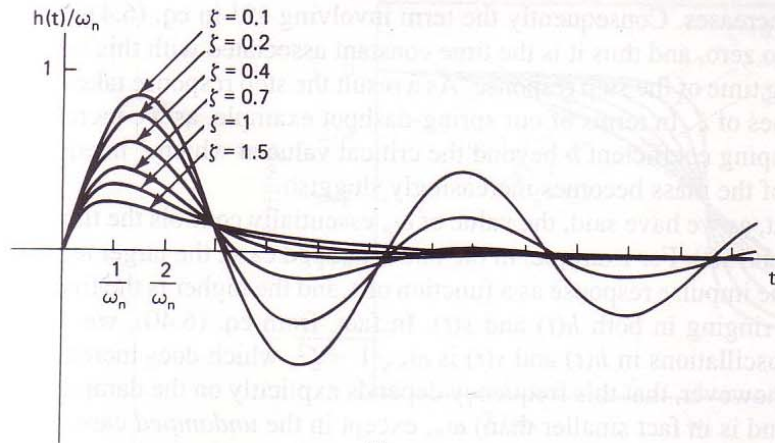
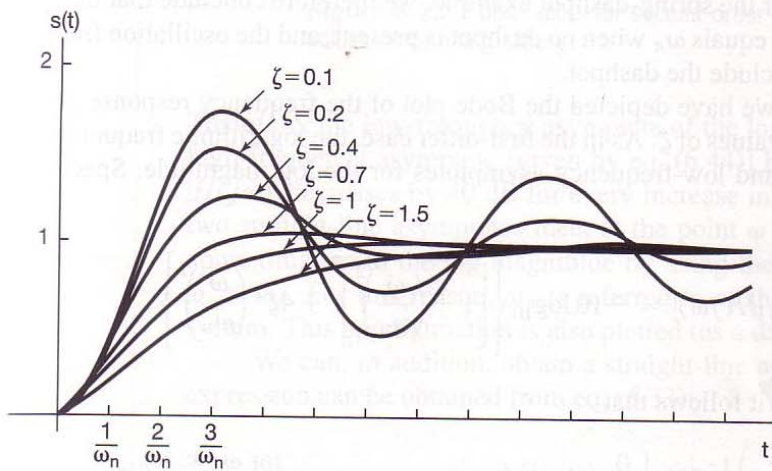


Thus, for $0 < \zeta < 1$, the second-order system has an impulse response that has damped oscillatory behavior, and in this case the system is referred to as being *underdamped*. If $\zeta > 1$, both c_1 and c_2 are real and negative, and the impulse response is the difference between two decaying exponentials. In this case, the system is *overdamped*. The case of $\zeta = 1$, when $c_1 = c_2$, is called the *critically damped* case. The impulse responses (multiplied by $1/\omega_n$) for second-order systems with different values of ζ are plotted in Figure 6.22(a).



(a)



(b)

Figure 6.22 Response of continuous-time second-order systems with different values of the damping ratio ζ : (a) impulse response; (b) step response.