

**Problem 5.5**

Specify the Nyquist rate and the Nyquist interval for each of the following signals:

- (a)  $g(t) = \text{sinc}(200t)$
- (b)  $g(t) = \text{sinc}^2(200t)$
- (c)  $g(t) = \text{sinc}(200t) + \text{sinc}^2(200t)$

**Solution**

- (a) The highest frequency component of

$$\begin{aligned} g(t) &= \text{sinc}(200t) \\ &= \frac{\sin(200\pi t)}{200\pi t} \end{aligned}$$

is 100 Hz. Hence, the Nyquist rate is 200 Hz and the Nyquist interval is 5 ms.

- (b) The highest frequency component of

$$g(t) = \text{sinc}^2(200t)$$

is twice that of  $g(t)$  in part (a); it is so because squaring a band-limited signal has the effect of doubling its highest frequency component. Hence, the Nyquist rate of

$$g(t) = \text{sinc}^2(200t)$$

is 400 Hz and the Nyquist interval is 2.5 ms.

- (c) The highest frequency component of the composite signal

$$g(t) = \text{sinc}(200t) + \text{sinc}^2(200t)$$

is determined by the component  $\text{sinc}^2(200t)$ . Hence, the Nyquist rate of this third signal is 400 Hz and the Nyquist interval is 2.5 ms.