

PROBLEM:

Consider a continuous-time signal

$$x(t) = A \cos(\omega_0 t + \phi)$$

We know that this signal is periodic with period $T_0 = 2\pi/\omega_0$; i.e. $x(t + T_0) = x(t)$ for all t . Now suppose that $x(t)$ is sampled to obtain the sequence

$$x[n] = x(nT_s) = A \cos(\omega_0 n T_s + \phi) = A \cos(\hat{\omega}_0 n + \phi)$$

where $\hat{\omega}_0 = \omega_0 T_s$.

Now a discrete-time signal is periodic with period N if $x[n + N] = x[n]$ for all n , where N is necessarily an integer.

- Will $x[n]$ be periodic for all possible sampling rates? If not, what condition on T_s will ensure that $x[n]$ is periodic with period N ?
- If $\omega_0 = 2000\pi$, what value of T_s will result in a periodic sequence with period $N = 100$?