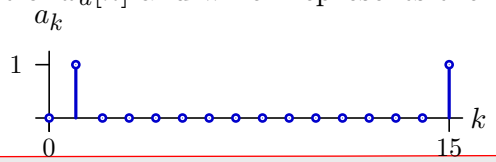
Inverse Fourier Series

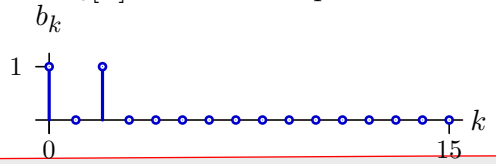
Part a. The following plot shows the Fourier series coefficients a_k for a discrete-time signal $x_a[n]$ that is periodic in n with period $N = 16$. Determine which of the functions shown at the bottom of this page (A through H) represents the real part of $x_a[n]$ and which represents the imaginary part of $x_a[n]$.



$$x_a[n] = \sum_{k=\langle 16\rangle} a_k e^{j2\pi kn/16} = e^{j2\pi n/16} + e^{j2\pi 15n/16} = e^{j2\pi n/16} + e^{-j2\pi n/16} = 2\cos(2\pi n/16)$$

Thus the real part of $x_a[n]$ is function E and the imaginary part is function C.

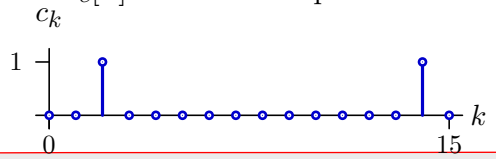
Part b. The following plot shows the Fourier series coefficients b_k for a discrete-time signal $x_b[n]$ that is periodic in n with period $N = 16$. Determine which of the functions shown at the bottom of this page (A through H) represents the real part of $x_b[n]$ and which represents the imaginary part of $x_b[n]$.



$$x_b[n] = \sum_{k=\langle 16\rangle} a_k e^{j2\pi kn/16} = e^{j2\pi 0/16} + e^{j2\pi 2n/16} = 1 + \cos(2\pi n/8) + j\sin(2\pi n/8)$$

Thus the real part of $x_b[n]$ is function D and the imaginary part is function G.

Part c. The following plot shows the Fourier series coefficients c_k for a discrete-time signal $x_c[n]$ that is periodic in n with period $N = 16$. Determine which of the functions shown at the bottom of this page (A through H) represents the real part of $x_c[n]$ and which represents the imaginary part of $x_c[n]$.



$$x_c[n] = \sum_{k=\langle 16\rangle} a_k e^{j2\pi kn/16} = e^{j2\pi 2/16} + e^{j2\pi 15n/16} = e^{j2\pi 2/16} + e^{-j2\pi 2n/16} = \cos(2\pi n/8)$$

Thus the real part of $x_c[n]$ is function B and the imaginary part is function C.

Part d. The following plot shows the Fourier series coefficients d_k for a discrete-time signal $x_d[n]$ that is periodic in n with period $N = 16$. Determine which of the functions shown at the bottom of this page (A through H) represents the real part of $x_d[n]$ and which represents the imaginary part of $x_d[n]$.

$$x_c[n] = \sum_{k=\langle 16\rangle} a_k e^{j2\pi kn/16} = e^{j2\pi 0/16} + e^{j2\pi 4n/16} = 1 + \cos(8\pi n/16) + j\sin(8\pi n/16)$$

Thus the real part of $x_d[n]$ is function H and the imaginary part is function A.

Functions A through H: