Discrete-Time Fourier Series

**Synthesis Equation**

\[ f[n] = f[n + N] = \sum_{k=\langle N \rangle} a_k e^{j\frac{2\pi k}{N} n} \]

**Analysis Equation**

\[ a_k = \frac{1}{N} \sum_{n=\langle N \rangle} f[n] e^{-j\frac{2\pi k}{N} n} \]
Find the DT Fourier Series Coefficients

Let $f[n]$ represent a periodic DT signal with period $N = 7$:

Determine the Fourier series coefficients $F[k]$ for $f[n]$. 

\[ f[n] \]

\[ \begin{align*}
  f[0] &= 1 \\
  f[1] &= 1 \\
  f[2] &= 1 \\
  f[3] &= 1 \\
  f[4] &= 1 \\
  f[5] &= 1 \\
  f[6] &= 1 \\
  f[7] &= 0 \\
  f[8] &= 0 \\
\end{align*} \]
Find the DT Fourier Series Coefficients

How would the answer change if the period were $N = 6$?

Determine the Fourier series coefficients $E[k]$ for $e[n]$. 
Find the DT Fourier Series Coefficients

Consider a new signal $g[n]$ derived from $f[n]$ as follows:

$$g[n] = 9 - 3f[n - 1]$$

Find the DTFS coefficients of $g[n]$. 
Find the DT Fourier Series Coefficients

Consider another new signal

\[ h[n] = (-1)^n f[n] \]

where

\[ f[n] \]

Find the DTFS coefficients of \( h[n] \).
Angular Trends

Which of the following plots shows the angle of $e^{-jx}$?

A

B

C

D

E

F

G

H

I

J

K
Angular Trends

Which of the following plots shows the angle of $1 + 0.8e^{jx}$?

A

B

C

D

E

F

G

H

I

J

K
Angular Trends

Which of the following plots shows the angle of \( \left( \frac{1 + 0.4 e^{jx}}{2 + 0.8 e^{jx}} \right) \)?
Angular Trends

Which of the following plots shows the angle of \((1 + e^{jx})\)?

A

B

C

D

E

F

G

H

I

J

K
Angular Trends

Which of the following plots shows the angle of \((1 + 0.8e^{j2x})\)?

A

B

C

D

E

F

G

H

I

J

K
Angular Trends

Which of the following plots shows the angle of \((0.9e^{jx} + 0.8e^{-jx})\)?

A

B

C

D

E

F

G

H

I

J

K
Angular Trends

Which of the following plots shows the angle of \( \left( \frac{1}{1+0.8e^{jx}} \right) \)?

A  

B  

C  

D  

E  

F  

G  

H  

I  

J  

K