$$f(x) = \cos(x)$$

$$x[n] = \cos(\qquad n)$$

$$x[n] = \cos(2\pi \ \frac{1}{8000} \ n)$$

$$x[n] = \cos(2\pi \ \frac{2}{8000} \ n)$$

$$x[n] = \cos(2\pi \ \frac{440}{8000} \ n)$$

$$f = \frac{f_{skutecna}}{F_s}, \qquad f_{skutecna} = f \, F_s$$

$$f = \frac{1}{Fs} \qquad f = 0 \qquad f = \frac{1}{2} \qquad f = 1$$

$$x[n] = A\cos(2\pi f n + \phi)$$

$$c = \sum_{n=0}^{N-1} x[n]a[n]$$

$$a_0[n] = \cos(2\pi \frac{0}{N} n)$$

$$a_1[n] = \cos(2\pi \frac{1}{N} n)$$

$$a_2[n] = \cos(2\pi \frac{2}{N} n)$$

$$\dots$$

$$a_{\frac{N}{2}}[n] = \cos(2\pi \frac{\frac{N}{2}}{N} n)$$

$$c_0 = \sum_{n=0}^{N-1} a_0[n]x[n]$$

$$c_1 = \sum_{n=0}^{N-1} a_1[n]x[n]$$

$$c_2 = \sum_{n=0}^{N-1} a_2[n]x[n]$$

$$\dots$$

$$c_{\frac{N}{2}} = \sum_{n=0}^{N-1} a_{\frac{N}{2}}[n]x[n]$$

$$\mathbf{c} = \mathbf{A}\mathbf{x}$$

$$xs[n] = c_0 + c_1\cos(2\pi \frac{1}{N} n) + c_2\cos(2\pi \frac{2}{N} n) + \ldots + c_{\frac{N}{2}}\cos(2\pi \frac{\frac{N}{2}}{N} n)$$

$$\sin(x) = \cos(x - \frac{\pi}{2})$$

$$a_0[n] = \cos(2\pi \frac{0}{N} n) \qquad b_0[n] = \sin(2\pi \frac{0}{N} n)$$

$$a_1[n] = \cos(2\pi \frac{1}{N} n) \qquad b_1[n] = \sin(2\pi \frac{1}{N} n)$$

$$a_2[n] = \cos(2\pi \frac{2}{N} n) \qquad b_2[n] = \sin(2\pi \frac{2}{N} n)$$

$$\dots \qquad \dots$$

$$a_{\frac{N}{2}}[n] = \cos(2\pi \frac{\frac{N}{2}}{N} n) \qquad b_{\frac{N}{2}}[n] = \sin(2\pi \frac{\frac{N}{2}}{N} n)$$

$$
\begin{aligned}
c_0 &= \sum_{n=0}^{N-1} a_0[n]x[n] \qquad & d_0 &= \sum_{n=0}^{N-1} b_0[n]x[n] \\
c_1 &= \sum_{n=0}^{N-1} a_1[n]x[n] \qquad & d_1 &= \sum_{n=0}^{N-1} b_1[n]x[n] \\
c_2 &= \sum_{n=0}^{N-1} a_2[n]x[n] \qquad & d_2 &= \sum_{n=0}^{N-1} b_2[n]x[n] \\
&\dots & &\dots \\
c_{\frac{N}{2}} &= \sum_{n=0}^{N-1} a_{\frac{N}{2}}[n]x[n] & d_{\frac{N}{2}} &= \sum_{n=0}^{N-1} b_{\frac{N}{2}}[n]x[n]
\end{aligned}
$$

$$\mathbf{c} = \mathbf{A}\mathbf{x}, \qquad \mathbf{d} = \mathbf{B}\mathbf{x}$$

$$
\begin{aligned}
xs[n] \quad = c_0 \quad &+ c_1 \cos(2\pi \frac{1}{N} n) + c_2 \cos(2\pi \frac{2}{N} n) + \ldots + c_{\frac{N}{2}} \cos(2\pi \frac{\frac{N}{2}}{N} n) \\
&+ d_1 \sin(2\pi \frac{1}{N} n) + d_2 \sin(2\pi \frac{2}{N} n) + \ldots + d_{\frac{N}{2}} \sin(2\pi \frac{\frac{N}{2}}{N} n)
\end{aligned}
$$

$$X_k = c_k - j d_k$$

$$
\begin{aligned}
X_k &= c_k - j d_k \\
&= \sum_{n=0}^{N-1} x[n] \cos(2\pi \frac{k}{N} n) - j \sum_{n=0}^{N-1} x[n] \sin(2\pi \frac{k}{N} n) \\
&= \sum_{n=0}^{N-1} x[n] \left[\cos(2\pi \frac{k}{N} n) - j \sin(2\pi \frac{k}{N} n) \right] \\
&= \sum_{n=0}^{N-1} x[n] e^{-j2\pi \frac{k}{N} n}
\end{aligned}
$$

$$X[k] = \sum_{n=0}^{N-1} x[n] e^{-j2\pi \frac{k}{N} n}, \quad k = 0 \ldots N-1$$

$$\mathbf{X} = \mathbf{W}\mathbf{x}$$

$$x[n] = \frac{1}{N} \sum_{k=0}^{N-1} X[k] e^{+j2\pi \frac{k}{N} n}$$