

TRANSFORMADAS DE FOURIER MATRICIAL

$$x(n) = [1, 8, 3, 10, 18, 5]$$

$$X(k) = \sum_{n=0}^{N-1} x(n) e^{-j \frac{2\pi kn}{N}} \quad W_N = e^{-j \frac{2\pi}{N}} \quad \therefore X(k) = \sum_{n=0}^{N-1} x(n) W_N^{kn}$$

$$W_8 = e^{-j \frac{2\pi(0)(0)}{8}} = \cos\left(\frac{2\pi(0)(0)}{8}\right) - j \sin\left(\frac{2\pi(0)(0)}{8}\right) = 1 - 0 = 1$$

$$W_8 = \cos\left(\frac{2\pi(0)(1)}{8}\right) - j \sin\left(\frac{2\pi(0)(1)}{8}\right) = \frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$$

...

	0	1	2	3	4	5	6	7	k
0	$W_8^0 W_8^0 W_8^0 W_8^0 W_8^0 W_8^0 W_8^0 W_8^0$								1
1	$W_8^0 W_8^1 W_8^2 W_8^3 W_8^4 W_8^5 W_8^6 W_8^7$								8
2	$W_8^0 W_8^2 W_8^4 W_8^6 W_8^8 W_8^{10} W_8^{12} W_8^{14}$								3
3	$W_8^0 W_8^3 W_8^6 W_8^9 W_8^{12} W_8^{15} W_8^{18} W_8^{21}$								1
4	$W_8^0 W_8^4 W_8^8 W_8^{12} W_8^{16} W_8^{20} W_8^{24} W_8^{28}$								0
5	$W_8^0 W_8^5 W_8^{10} W_8^{15} W_8^{20} W_8^{25} W_8^{30} W_8^{35}$								1
6	$W_8^0 W_8^6 W_8^{12} W_8^{18} W_8^{24} W_8^{30} W_8^{36} W_8^{42}$								8
7	$W_8^0 W_8^7 W_8^{14} W_8^{21} W_8^{28} W_8^{35} W_8^{42} W_8^{49}$								5

	0	1	2	3	4	5	6	7	
0	1	1	1	1	1	1	1	1	1
1	1	$\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	-j	$-\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	-1	$-\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	j	$\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	8
2	1	-j	-1	j	1	-j	-1	j	3
3	1	$-\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	j	$\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	-1	$\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	-j	$-\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	1
4	1	-1	1	-1	1	-1	1	-1	0
5	1	$\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	-j	$\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	-1	$\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	j	$-\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	1
6	1	j	-1	-j	1	j	-1	-j	8
7	1	$\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	j	$-\frac{\sqrt{2}}{2} + j \frac{\sqrt{2}}{2}$	-1	$-\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	-j	$\frac{\sqrt{2}}{2} - j \frac{\sqrt{2}}{2}$	5

$$x(n) = [1, 8, 3, 1, 0, 1, 8, 5]$$

$$x(0) = 1(1) + 8(1) + 3(1) + 1(1) + 0(1) + 1(1) + 8(1) + 5(1) = 27$$

$$\begin{aligned} x(1) &= 1(1) + 8\left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) + 3(-j) + 1\left(-\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) + 0(-1) + 1\left(-\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) + 8(j) + 5\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) \\ &= \frac{11\sqrt{2}}{2} + j\left(5 - \frac{3\sqrt{2}}{2}\right) \end{aligned}$$

$$x(2) = 1(1) + 8(j) + 3(-1) + 1(j) + 0(-1) + 1(-j) + 8(1) + 5(j) = -10 - 3j$$

$$\begin{aligned} x(3) &= 1(1) + 8\left(-\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) + 3(j) + 1\left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) + 0(-1) + 1\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) + 8(-j) + 5\left(-\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) \\ &= 1 + \frac{11\sqrt{2}}{2} + j\left(5 - \frac{3\sqrt{2}}{2}\right) \end{aligned}$$

$$x(4) = 1(1) + 8(-1) + 3(1) + 1(-1) + 0(1) + 1(-1) + 8(1) + 5(-1) = -3 + 0j$$

$$\begin{aligned} x(5) &= 1(1) + 8\left(-\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) + 3(-j) + 1\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) + 0(-1) + 1\left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) + 8(j) + 5\left(-\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) \\ &= 1 - \frac{11\sqrt{2}}{2} + j\left(3 - \frac{13\sqrt{2}}{2}\right) \end{aligned}$$

$$x(6) = 1(1) + 8(j) + 3(-1) + 1(-j) + 0(1) + 1(j) + 8(-1) + 5(-j) = -10 + 3j$$

$$\begin{aligned} x(7) &= 1(1) + 8\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) + 3(j) + 1\left(-\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) + 0(-1) + 1\left(-\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) + 8(j) + 5\left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right) \\ &= 1 + \frac{11\sqrt{2}}{2} + j\left(-5 + \frac{3\sqrt{2}}{2}\right) \end{aligned}$$