Mateusz Zajaczek – Variant 1: IDFT in Matrix Notation

Vector x_μ (N=10): [6, 2, 4, 3, 4, 5, 0, 0, 0, 0]^T

Nonzero coefficients: 6

Max |Im{x[k]}|: 1.018e+00

Matrix K = [k·μ] for k, μ = 0..N−1

```
[
   0    0    0    0    0    0    0    0    0    0
   0    1    2    3    4    5    6    7    8    9
   0    2    4    6    8   10   12   14   16   18
   0    3    6    9   12   15   18   21   24   27
   0    4    8   12   16   20   24   28   32   36
   0    5   10   15   20   25   30   35   40   45
   0    6   12   18   24   30   36   42   48   54
   0    7   14   21   28   35   42   49   56   63
   0    8   16   24   32   40   48   56   64   72
   0    9   18   27   36   45   54   63   72   81
]
```

Matrix W = exp(j·2π/N · K) — real and imaginary parts:

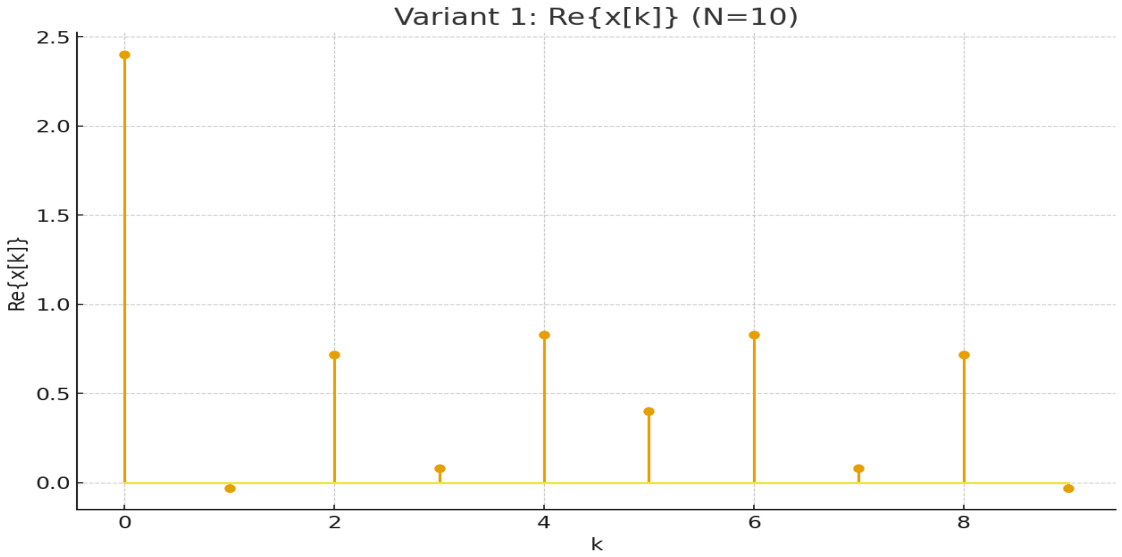
Re(W):

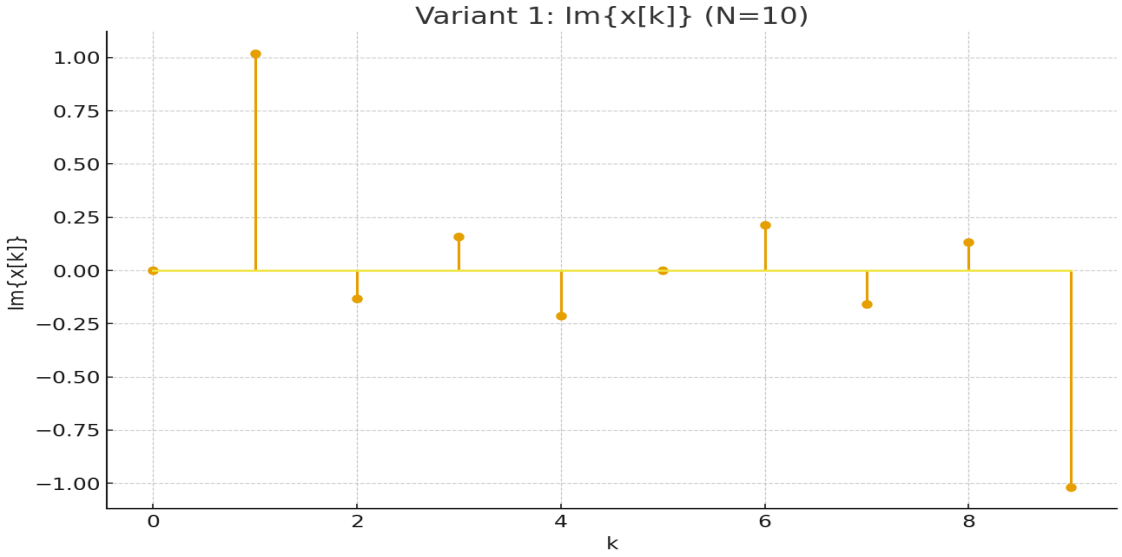
```
[
   1.000    1.000    1.000    1.000    1.000    1.000    1.000    1.000    1.000    1.000
   1.000    0.809    0.309   -0.309   -0.809   -1.000   -0.809   -0.309    0.309    0.809
   1.000    0.309   -0.809   -0.809    0.309    1.000    0.309   -0.809   -0.809    0.309
   1.000   -0.309   -0.809    0.809    0.309   -1.000    0.309    0.809   -0.809   -0.309
   1.000   -0.809    0.309    0.309   -0.809    1.000   -0.809    0.309    0.309   -0.809
   1.000   -1.000    1.000   -1.000    1.000   -1.000    1.000   -1.000    1.000   -1.000
   1.000   -0.809    0.309    0.309   -0.809    1.000   -0.809    0.309    0.309   -0.809
   1.000   -0.309   -0.809    0.809    0.309   -1.000    0.309    0.809   -0.809   -0.309
   1.000    0.309   -0.809   -0.809    0.309    1.000    0.309   -0.809   -0.809    0.309
   1.000    0.809    0.309   -0.309   -0.809   -1.000   -0.809   -0.309    0.309    0.809
]
```

Im(W):

```
[
   0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000
   0.000    0.588    0.951    0.951    0.588    0.000   -0.588   -0.951   -0.951   -0.588
   0.000    0.951    0.588   -0.588   -0.951   -0.000    0.951    0.588   -0.588   -0.951
   0.000    0.951   -0.588   -0.588    0.951    0.000   -0.951    0.588    0.588   -0.951
   0.000    0.588   -0.951    0.951   -0.588   -0.000    0.588   -0.951    0.951   -0.588
   0.000    0.000   -0.000    0.000   -0.000    0.000   -0.000    0.000   -0.000    0.000
   0.000   -0.588    0.951   -0.951    0.588   -0.000   -0.588    0.951   -0.951    0.588
   0.000   -0.951    0.588    0.588   -0.951    0.000    0.951   -0.588   -0.588    0.951
   0.000   -0.951   -0.588    0.588    0.951   -0.000   -0.951   -0.588    0.588    0.951
   0.000   -0.588   -0.951   -0.951   -0.588    0.000    0.588    0.951    0.951    0.588
]
```

Synthesized signal x[k] via IDFT: x[k] = (1/N) · W · x_μ


Variant 1: Re{x[k]} (N=10)
Re{x[k]}
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
k


Variant 1: Im{x[k]} (N=10)
Im{x[k]}
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
2
4
6
8
k