```
%verification of the subsequent steps of the 10-point DFT algorithm
clc
clear

syms x0 x1 x2 x3 x4 x5 x6 x7 x8 x9
syms X0 X1 X2 X3 X4 X5 X6 X7 X8 X9
syms a0 a1 a2 a3 a4 a5 a6 a7 a8 a9
syms A0 A1 A2 A3 A4 A5 A6 A7 A8 A9

x = [x0; x1; x2; x3; x4; x5; x6; x7; x8; x9];
X = [X0; X1; X2; X3; X4; X5; X6; X7; X8; X9];
a = [a0; a1; a2; a3; a4; a5; a6; a7; a8; a9];
A = [A0; A1; A2; A3; A4; A5; A6; A7; A8; A9];

w10=exp(-j*2*pi/10)

W10=[];
for k=0:9
W10 = [W10; [w10^(k*0) w10^(k*1) w10^(k*2) w10^(k*3) w10^(k*4)
 w10^(k*5) w10^(k*6) w10^(k*7) w10^(k*8) w10^(k*9)]];
end

 V10=[1 0 0 0 0 0 0 0 0 0;
     0 1 0 0 0 0 0 0 0 1;
     0 0 1 0 0 0 0 0 1 0;
     0 0 0 1 0 0 0 1 0 0;
     0 0 0 0 1 0 1 0 0 0;
     0 0 0 0 0 1 0 0 0 0;
     0 0 0 0 1 0 -1 0 0 0;
     0 0 0 1 0 0 0 -1 0 0;
     0 0 1 0 0 0 0 0 -1 0;
     0 1 0 0 0 0 0 0 0 -1]


 W10_1=[W10(1,:);
    (W10(2,:)+W10(10,:))/2;
    (W10(3,:)+W10(9,:))/2;
    (W10(4,:)+W10(8,:))/2;
    (W10(5,:)+W10(7,:))/2;
    W10(6,:);
    (W10(5,:)-W10(7,:))/2;
    (W10(4,:)-W10(8,:))/2;
    (W10(3,:)-W10(9,:))/2;
    (W10(2,:)-W10(10,:))/2]

display('verification of the algorithm (8)')
 display(W10 - V10*W10_1)


w10 =

   0.8090 - 0.5878i
```

```
V10 =

     1     0     0     0     0     0     0     0     0     0
     0     1     0     0     0     0     0     0     0     1
     0     0     1     0     0     0     0     0     1     0
     0     0     0     1     0     0     0     1     0     0
     0     0     0     0     1     0     1     0     0     0
     0     0     0     0     0     1     0     0     0     0
     0     0     0     0     1     0    -1     0     0     0
     0     0     0     1     0     0     0    -1     0     0
     0     0     1     0     0     0     0     0    -1     0
     0     1     0     0     0     0     0     0     0    -1


W10_1 =

  Columns 1 through 4

   1.0000 + 0.0000i   1.0000 + 0.0000i   1.0000 + 0.0000i   1.0000 +
0.0000i
   1.0000 + 0.0000i   0.8090 + 0.0000i   0.3090 + 0.0000i  -0.3090 +
0.0000i
   1.0000 + 0.0000i   0.3090 + 0.0000i  -0.8090 + 0.0000i  -0.8090 -
0.0000i
   1.0000 + 0.0000i  -0.3090 + 0.0000i  -0.8090 - 0.0000i   0.8090 -
0.0000i
   1.0000 + 0.0000i  -0.8090 + 0.0000i   0.3090 - 0.0000i   0.3090 +
0.0000i
   1.0000 + 0.0000i  -1.0000 + 0.0000i   1.0000 + 0.0000i  -1.0000 -
0.0000i
   0.0000 + 0.0000i   0.0000 - 0.5878i  -0.0000 + 0.9511i   0.0000 -
0.9511i
   0.0000 + 0.0000i   0.0000 - 0.9511i   0.0000 + 0.5878i  -0.0000 +
0.5878i
   0.0000 + 0.0000i  -0.0000 - 0.9511i   0.0000 - 0.5878i   0.0000 +
0.5878i
   0.0000 + 0.0000i  -0.0000 - 0.5878i  -0.0000 - 0.9511i   0.0000 -
0.9511i

  Columns 5 through 8

   1.0000 + 0.0000i   1.0000 + 0.0000i   1.0000 + 0.0000i   1.0000 +
0.0000i
  -0.8090 + 0.0000i  -1.0000 - 0.0000i  -0.8090 - 0.0000i  -0.3090 -
0.0000i
   0.3090 - 0.0000i   1.0000 + 0.0000i   0.3090 + 0.0000i  -0.8090 +
0.0000i
   0.3090 + 0.0000i  -1.0000 - 0.0000i   0.3090 - 0.0000i   0.8090 +
0.0000i
  -0.8090 - 0.0000i   1.0000 + 0.0000i  -0.8090 + 0.0000i   0.3090 -
0.0000i
   1.0000 + 0.0000i  -1.0000 - 0.0000i   1.0000 + 0.0000i  -1.0000 -
0.0000i
```

```
   0.0000 + 0.5878i  -0.0000 - 0.0000i   0.0000 - 0.5878i  -0.0000 +
0.9511i
  -0.0000 - 0.9511i   0.0000 - 0.0000i  -0.0000 + 0.9511i  -0.0000 -
0.5878i
  -0.0000 + 0.9511i  -0.0000 - 0.0000i  -0.0000 - 0.9511i   0.0000 -
0.5878i
   0.0000 - 0.5878i   0.0000 + 0.0000i   0.0000 + 0.5878i   0.0000 +
0.9511i

  Columns 9 through 10

   1.0000 + 0.0000i   1.0000 + 0.0000i
   0.3090 - 0.0000i   0.8090 - 0.0000i
  -0.8090 - 0.0000i   0.3090 - 0.0000i
  -0.8090 + 0.0000i  -0.3090 - 0.0000i
   0.3090 + 0.0000i  -0.8090 - 0.0000i
   1.0000 + 0.0000i  -1.0000 - 0.0000i
  -0.0000 - 0.9511i   0.0000 + 0.5878i
   0.0000 - 0.5878i   0.0000 + 0.9511i
   0.0000 + 0.5878i  -0.0000 + 0.9511i
  -0.0000 + 0.9511i  -0.0000 + 0.5878i

verification of the algorithm (8)
   1.0e-15 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.1110 - 0.1110i   0.0000 +
0.1110i
   0.0000 + 0.0000i  -0.0555 + 0.0000i   0.0000 + 0.1110i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.1110 + 0.0000i   0.0555 - 0.1110i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 -
0.1110i
   0.0000 + 0.0000i   0.0000 + 0.1110i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0555 - 0.1110i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 - 0.1110i   0.0000 +
0.0000i

  Columns 5 through 8

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.1110 + 0.0000i   0.2220 + 0.0000i   0.0000 + 0.1110i   0.0000 +
0.0000i
```

```
  -0.0555 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.1110i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.1110i   0.0000 +
0.0000i
   0.0555 - 0.1110i   0.0000 + 0.0000i   0.0555 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i  -0.2220 + 0.0000i   0.0000 + 0.1110i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i

  Columns 9 through 10

   0.0000 + 0.0000i   0.0000 + 0.0000i
  -0.0555 + 0.0000i   0.0000 - 0.1110i
   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i  -0.0555 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.1110i
   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 - 0.1110i
  -0.1110 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i
```

```
 W10_2 = [W10_1(:,1) ...
     [W10_1(:,2)+W10_1(:,10)]/2 [W10_1(:,3)+W10_1(:,9)]/2
 [W10_1(:,4)+W10_1(:,8)]/2 [W10_1(:,5)+W10_1(:,7)]/2 ...
     [W10_1(:,6)] ...
     [W10_1(:,5)-W10_1(:,7)]/2 [W10_1(:,4)-W10_1(:,8)]/2  [W10_1(:,3)-
W10_1(:,9)]/2 [W10_1(:,2)-W10_1(:,10)]/2]

display('verification of the algorithm (11)')
 display(W10 - V10*W10_2*V10)

 W10_1(1:6,1:6) - W10_2(1:6,1:6)
 W10_1(7:10,7:10) + W10_2(7:10,7:10)

  V10h=[1 0 0 0 0 1 0 0 0 0;
       0 1 0 0 1 0 0 0 0 0;
       0 0 1 1 0 0 0 0 0 0;
       0 0 1 -1 0 0 0 0 0 0;
       0 1 0 0 -1 0 0 0 0 0;
       1 0 0 0 0 -1 0 0 0 0;
       0 0 0 0 0 0 1 0 0 1;
       0 0 0 0 0 0 0 1 1 0;
       0 0 0 0 0 0 0 1 -1 0;
       0 0 0 0 0 0 1 0 0 -1]
```

```
V10h-2*(V10h^-1)

W10_3 = [(W10_2(1,:)+W10_2(6,:))/2;
         (W10_2(2,:)+W10_2(5,:))/2;
         (W10_2(3,:)+W10_2(4,:))/2;
        ( W10_2(3,:)-W10_2(4,:))/2;
         (W10_2(2,:)-W10_2(5,:))/2;
         (W10_2(1,:)-W10_2(6,:))/2;
         (W10_2(7,:)+W10_2(10,:))/2;
         (W10_2(8,:)+W10_2(9,:))/2;
         (W10_2(8,:)-W10_2(9,:))/2;
         (W10_2(7,:)-W10_2(10,:))/2]

display('verification of the algorithm (13)')
 display(W10 - V10*V10h*W10_3*V10)


W10_2 =

  Columns 1 through 4

   1.0000 + 0.0000i   1.0000 + 0.0000i   1.0000 + 0.0000i   1.0000 +
 0.0000i
   1.0000 + 0.0000i   0.8090 - 0.0000i   0.3090 - 0.0000i  -0.3090 -
 0.0000i
   1.0000 + 0.0000i   0.3090 - 0.0000i  -0.8090 - 0.0000i  -0.8090 +
 0.0000i
   1.0000 + 0.0000i  -0.3090 - 0.0000i  -0.8090 + 0.0000i   0.8090 +
 0.0000i
   1.0000 + 0.0000i  -0.8090 - 0.0000i   0.3090 + 0.0000i   0.3090 -
 0.0000i
   1.0000 + 0.0000i  -1.0000 - 0.0000i   1.0000 + 0.0000i  -1.0000 -
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 - 0.0000i  -0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.0000i  -0.0000 -
 0.0000i
   0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 -
 0.0000i
   0.0000 + 0.0000i  -0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 +
 0.0000i

  Columns 5 through 8

   1.0000 + 0.0000i   1.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
  -0.8090 - 0.0000i  -1.0000 - 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.3090 + 0.0000i   1.0000 + 0.0000i  -0.0000 - 0.0000i   0.0000 -
 0.0000i
   0.3090 - 0.0000i  -1.0000 - 0.0000i  -0.0000 + 0.0000i  -0.0000 -
 0.0000i
  -0.8090 - 0.0000i   1.0000 + 0.0000i   0.0000 - 0.0000i  -0.0000 +
 0.0000i
```

```
   1.0000 + 0.0000i  -1.0000 - 0.0000i  -0.0000 - 0.0000i   0.0000 -
0.0000i
   0.0000 - 0.0000i  -0.0000 - 0.0000i  -0.0000 + 0.5878i   0.0000 -
0.9511i
  -0.0000 + 0.0000i   0.0000 - 0.0000i   0.0000 - 0.9511i   0.0000 +
0.5878i
  -0.0000 - 0.0000i  -0.0000 - 0.0000i  -0.0000 + 0.9511i  -0.0000 +
0.5878i
   0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 - 0.5878i   0.0000 -
0.9511i

  Columns 9 through 10

   0.0000 + 0.0000i   0.0000 + 0.0000i
  -0.0000 + 0.0000i  -0.0000 + 0.0000i
   0.0000 + 0.0000i  -0.0000 + 0.0000i
   0.0000 - 0.0000i   0.0000 + 0.0000i
  -0.0000 - 0.0000i   0.0000 + 0.0000i
  -0.0000 - 0.0000i   0.0000 + 0.0000i
  -0.0000 + 0.9511i  -0.0000 - 0.5878i
  -0.0000 + 0.5878i   0.0000 - 0.9511i
  -0.0000 - 0.5878i   0.0000 - 0.9511i
   0.0000 - 0.9511i   0.0000 - 0.5878i

verification of the algorithm (11)
   1.0e-15 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.1110 + 0.0000i   0.0000 + 0.0000i   0.0555 +
0.0000i
   0.0000 + 0.0000i   0.0555 + 0.0000i   0.1110 - 0.1110i   0.0000 +
0.1110i
   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 + 0.1110i   0.1110 +
0.0000i
   0.0000 + 0.0000i   0.1110 - 0.1110i   0.0555 + 0.0000i   0.0000 +
0.1110i
   0.0000 + 0.0000i   0.2220 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0555 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i  -0.0555 + 0.0000i   0.0000 - 0.1110i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0555 + 0.0000i   0.0000 + 0.1110i   0.0000 -
0.1110i
   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 + 0.0000i   0.0555 +
0.0000i

  Columns 5 through 8

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
```

```
   0.1110 - 0.1110i   0.2220 + 0.0000i   0.0000 + 0.1110i   0.0000 -
0.1110i
  -0.0555 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 +
0.0000i
   0.0000 + 0.1110i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.1110 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0555 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.1110i   0.0555 +
0.0000i
   0.0555 + 0.0000i   0.0000 + 0.0000i   0.0555 + 0.0000i   0.0000 -
0.1110i
   0.0000 + 0.0000i  -0.2220 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.1110i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 +
0.1110i

  Columns 9 through 10

   0.0000 + 0.0000i   0.0000 + 0.0000i
  -0.0555 + 0.1110i   0.1110 - 0.1110i
   0.0000 + 0.0000i   0.0555 + 0.1110i
   0.0000 + 0.0000i   0.0000 + 0.1110i
   0.0000 + 0.0000i   0.0000 + 0.1110i
  -0.2220 + 0.0000i   0.0000 + 0.0000i
   0.0555 + 0.1110i   0.0000 - 0.1110i
   0.0000 + 0.1110i  -0.0555 + 0.0000i
  -0.1110 - 0.1110i   0.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i


ans =

   1.0e-14 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i  -0.0777 + 0.0555i  -0.0278 + 0.0971i   0.0111 +
0.0999i
   0.0000 + 0.0000i  -0.0333 + 0.0749i   0.0555 + 0.0472i   0.0444 -
0.0472i
   0.0000 + 0.0000i   0.0278 + 0.0500i   0.0666 - 0.0250i  -0.0333 -
0.0305i
   0.0000 + 0.0000i   0.0777 + 0.0194i  -0.0222 - 0.0250i  -0.0111 +
0.0250i
   0.0000 + 0.0000i   0.1110 + 0.0056i  -0.0888 - 0.0028i   0.0444 -
0.0028i

  Columns 5 through 6
```

```
   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0111 + 0.0638i   0.0000 + 0.0000i
  -0.0056 - 0.0749i   0.0000 + 0.0000i
  -0.0111 + 0.0472i   0.0000 + 0.0000i
   0.0222 - 0.0139i   0.0000 + 0.0000i
  -0.0222 - 0.0028i   0.0000 + 0.0000i


ans =

   1.0e-15 *

   0.2220 - 0.1110i  -0.1110 + 0.4441i  -0.0694 - 0.7772i   0.1388 +
 0.6661i
  -0.1388 + 0.2220i  -0.3886 - 0.3331i   0.4441 - 0.5551i   0.0833 +
 0.9992i
  -0.2359 - 0.2220i   0.6661 - 0.3331i   0.6106 + 0.5551i  -0.2637 +
 0.9992i
   0.8049 + 0.2220i   0.2776 + 0.4441i  -0.3469 + 0.7772i  -0.8327 +
 0.5551i


V10h =

     1     0     0     0     0     1     0     0     0     0
     0     1     0     0     1     0     0     0     0     0
     0     0     1     1     0     0     0     0     0     0
     0     0     1    -1     0     0     0     0     0     0
     0     1     0     0    -1     0     0     0     0     0
     1     0     0     0     0    -1     0     0     0     0
     0     0     0     0     0     0     1     0     0     1
     0     0     0     0     0     0     0     1     1     0
     0     0     0     0     0     0     0     1    -1     0
     0     0     0     0     0     0     1     0     0    -1


ans =

     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0


W10_3 =

  Columns 1 through 4
```

```
  1.0000 + 0.0000i  -0.0000 - 0.0000i   1.0000 + 0.0000i  -0.0000 -
0.0000i
  1.0000 + 0.0000i  -0.0000 - 0.0000i   0.3090 - 0.0000i   0.0000 -
0.0000i
  1.0000 + 0.0000i   0.0000 - 0.0000i  -0.8090 - 0.0000i  -0.0000 +
0.0000i
  0.0000 + 0.0000i   0.3090 - 0.0000i   0.0000 - 0.0000i  -0.8090 -
0.0000i
  0.0000 + 0.0000i   0.8090 - 0.0000i   0.0000 - 0.0000i  -0.3090 -
0.0000i
  0.0000 + 0.0000i   1.0000 + 0.0000i  -0.0000 - 0.0000i   1.0000 +
0.0000i
  0.0000 + 0.0000i  -0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 -
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 - 0.0000i  -0.0000 -
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.0000i  -0.0000 -
0.0000i

 Columns 5 through 8

  1.0000 + 0.0000i  -0.0000 - 0.0000i  -0.0000 - 0.0000i   0.0000 -
0.0000i
 -0.8090 - 0.0000i  -0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.0000i
  0.3090 + 0.0000i   0.0000 - 0.0000i  -0.0000 - 0.0000i   0.0000 -
0.0000i
  0.0000 + 0.0000i   1.0000 + 0.0000i   0.0000 - 0.0000i   0.0000 -
0.0000i
  0.0000 - 0.0000i  -1.0000 - 0.0000i  -0.0000 + 0.0000i   0.0000 +
0.0000i
 -0.0000 - 0.0000i   1.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 -
0.9511i
 -0.0000 + 0.0000i  -0.0000 - 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.5878i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.9511i   0.0000 +
0.0000i
 -0.0000 - 0.0000i  -0.0000 - 0.0000i  -0.0000 + 0.5878i   0.0000 +
0.0000i

 Columns 9 through 10

 -0.0000 - 0.0000i   0.0000 + 0.0000i
 -0.0000 + 0.0000i  -0.0000 + 0.0000i
  0.0000 + 0.0000i  -0.0000 + 0.0000i
 -0.0000 + 0.0000i  -0.0000 + 0.0000i
 -0.0000 + 0.0000i  -0.0000 + 0.0000i
  0.0000 + 0.0000i  -0.0000 - 0.0000i
  0.0000 + 0.0000i   0.0000 - 0.5878i
 -0.0000 + 0.0000i   0.0000 - 0.9511i
```

```
   0.0000 + 0.5878i  -0.0000 + 0.0000i
  -0.0000 + 0.9511i  -0.0000 + 0.0000i

verification of the algorithm (13)
   1.0e-15 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.1110 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0555 + 0.0000i  -0.0555 +
 0.0000i
   0.0000 + 0.0000i   0.0555 + 0.1110i   0.0000 - 0.1110i  -0.1110 +
 0.1110i
   0.0000 + 0.0000i   0.0555 + 0.1110i   0.0000 + 0.1110i   0.1110 +
 0.0000i
   0.0000 + 0.0000i   0.0000 - 0.1110i   0.1110 + 0.0000i   0.0000 +
 0.1110i
   0.0000 + 0.0000i   0.2220 + 0.0000i   0.0000 + 0.0000i  -0.2220 +
 0.0000i
   0.0000 + 0.0000i  -0.1110 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0555 - 0.1110i   0.1110 + 0.1110i  -0.1110 -
 0.1110i
   0.0000 + 0.0000i   0.1110 - 0.1110i   0.0555 + 0.0000i   0.0555 +
 0.0000i

  Columns 5 through 8

   0.1110 + 0.0000i   0.0000 + 0.0000i   0.1110 + 0.0000i   0.1110 +
 0.0000i
   0.0000 - 0.1110i   0.0000 + 0.0000i  -0.1110 + 0.1110i   0.0000 -
 0.1110i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0555 - 0.1110i  -0.1110 +
 0.0000i
   0.0000 + 0.1110i   0.2220 + 0.0000i   0.0000 + 0.0000i   0.1110 +
 0.0000i
   0.0000 + 0.1110i  -0.2220 + 0.0000i   0.0000 - 0.1110i   0.0555 +
 0.0000i
   0.2220 + 0.0000i   0.0000 + 0.0000i   0.2220 + 0.0000i  -0.2220 +
 0.0000i
   0.0000 + 0.0000i  -0.2220 + 0.0000i   0.0000 + 0.1110i   0.0555 +
 0.0000i
   0.0555 + 0.0000i   0.2220 + 0.0000i   0.0555 + 0.0000i   0.0000 -
 0.1110i
   0.0555 + 0.0000i  -0.2220 + 0.0000i   0.0555 + 0.0000i  -0.1110 +
 0.1110i
   0.1110 + 0.1110i   0.2220 + 0.0000i   0.1110 - 0.2220i   0.1110 +
 0.1110i

  Columns 9 through 10
```

```
   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.1110i   0.0000 - 0.1110i
  -0.1110 + 0.0000i   0.0555 + 0.0000i
   0.0000 + 0.0000i   0.0555 - 0.1110i
   0.0555 + 0.0000i  -0.1110 + 0.1110i
  -0.2220 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.1110i  -0.1110 - 0.1110i
   0.0000 + 0.1110i   0.0000 + 0.0000i
   0.0000 - 0.1110i   0.0000 + 0.1110i
   0.0555 + 0.0000i   0.1110 + 0.0000i
```

```
 S10c = diag([1 1 1 -1 -1 1 1 1 1 -1])
 S10r = diag([1 1 -1 1 1 1 1 1 1 1])

W10_4 = S10r*W10_3*S10c

display('verification of the algorithm (14)')
display(W10 - V10*V10h*S10r*W10_4*S10c*V10)


%wersja 1
T12x10=[1 0 0 0 0 0 0 0 0 0;
      0 0 1 0 1 0 0 0 0 0;
      0 0 1 0 -1 0 0 0 0 0;
      0 0 0 0 0 1 0 0 0 0;
      0 1 0 1 0 0 0 0 0 0;
      0 1 0 -1 0 0 0 0 0 0;
      0 0 0 0 0 0 0 -1 0 0;
      0 0 0 0 0 0 0 0 0 1;
      0 0 0 0 0 0 0 1 0 1;
      0 0 0 0 0 0 -1 0 0 0;
      0 0 0 0 0 0 0 0 1 0;
      0 0 0 0 0 0 1 0 1 0]

A14x12=[1 0 0 0 0 0 0 0 0 0 0 0;
     0 (a1+a2)/2 0 0 0 0 0 0 0 0 0 0;
     0 0 (a1-a2)/2 0 0 0 0 0 0 0 0 0;
     0 0 1 0 0 0 0 0 0 0 0 0;
     0 0 0 1 0 0 0 0 0 0 0 0;
     0 0 0 0 (a1+a2)/2 0 0 0 0 0 0 0;
     0 0 0 0 0 (a1-a2)/2 0 0 0 0 0 0;
     0 0 0 0 0 1 0 0 0 0 0 0;
     0 0 0 0 0 0 a3+a4 0 0 0 0 0;
     0 0 0 0 0 0 0 a3-a4 0 0 0 0;
     0 0 0 0 0 0 0 0 a4 0 0 0;
     0 0 0 0 0 0 0 0 0 a3+a4 0 0;
     0 0 0 0 0 0 0 0 0 0 a3-a4 0;
     0 0 0 0 0 0 0 0 0 0 0 a4]


T10x14 = [1 0 0 1 0 0 0 0 0 0 0 0 0 0;
        1 1 1 0 0 0 0 0 0 0 0 0 0 0;
       -1 1 -1 0 0 0 0 0 0 0 0 0 0 0;
```

```
        0 0 0 0 1 1 1 0 0 0 0 0 0 0;
        0 0 0 0 -1 1 -1 0 0 0 0 0 0 0;
        0 0 0 0 1 0 0 1 0 0 0 0 0 0;
        0 0 0 0 0 0 0 0 1 0 1 0 0 0;
        0 0 0 0 0 0 0 0 0 1 1 0 0 0;
        0 0 0 0 0 0 0 0 0 0 0 1 0 1;
        0 0 0 0 0 0 0 0 0 0 0 0 1 1]

display('verification of the algorithm (15)')
display(W10 - V10*V10h*S10r*T10x14*A14x12*T12x10*S10c*V10)
```

S10c =

1	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0
0	0	0	-1	0	0	0	0	0	0
0	0	0	0	-1	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	-1

S10r =

1	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	0	-1	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	1

W10_4 =

Columns 1 through 4

```
   1.0000 + 0.0000i  -0.0000 - 0.0000i   1.0000 + 0.0000i   0.0000 +
 0.0000i
   1.0000 + 0.0000i  -0.0000 - 0.0000i   0.3090 - 0.0000i   0.0000 +
 0.0000i
  -1.0000 + 0.0000i  -0.0000 + 0.0000i   0.8090 + 0.0000i  -0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.3090 - 0.0000i   0.0000 - 0.0000i   0.8090 +
 0.0000i
   0.0000 + 0.0000i   0.8090 - 0.0000i   0.0000 - 0.0000i   0.3090 +
 0.0000i
```

```
   0.0000 + 0.0000i   1.0000 + 0.0000i  -0.0000 - 0.0000i  -1.0000 -
0.0000i
   0.0000 + 0.0000i  -0.0000 + 0.0000i  -0.0000 + 0.0000i  -0.0000 -
0.0000i
   0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 - 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.0000i   0.0000 +
0.0000i

  Columns 5 through 8

  -1.0000 - 0.0000i  -0.0000 - 0.0000i  -0.0000 - 0.0000i   0.0000 -
0.0000i
   0.8090 + 0.0000i  -0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.0000i
   0.3090 + 0.0000i  -0.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.0000i
  -0.0000 - 0.0000i   1.0000 + 0.0000i   0.0000 - 0.0000i   0.0000 -
0.0000i
   0.0000 + 0.0000i  -1.0000 - 0.0000i  -0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   1.0000 + 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.0000i
  -0.0000 - 0.0000i   0.0000 + 0.0000i  -0.0000 + 0.0000i   0.0000 -
0.9511i
   0.0000 + 0.0000i  -0.0000 - 0.0000i   0.0000 + 0.0000i  -0.0000 +
0.5878i
  -0.0000 - 0.0000i   0.0000 + 0.0000i   0.0000 - 0.9511i   0.0000 +
0.0000i
   0.0000 + 0.0000i  -0.0000 - 0.0000i  -0.0000 + 0.5878i   0.0000 +
0.0000i

  Columns 9 through 10

  -0.0000 - 0.0000i  -0.0000 - 0.0000i
  -0.0000 + 0.0000i   0.0000 - 0.0000i
  -0.0000 - 0.0000i  -0.0000 + 0.0000i
  -0.0000 + 0.0000i   0.0000 - 0.0000i
  -0.0000 + 0.0000i   0.0000 - 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0000 + 0.0000i  -0.0000 + 0.5878i
  -0.0000 + 0.0000i  -0.0000 + 0.9511i
   0.0000 + 0.5878i   0.0000 - 0.0000i
  -0.0000 + 0.9511i   0.0000 - 0.0000i

verification of the algorithm (14)
   1.0e-15 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.1110 +
0.0000i
```

```
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0555 + 0.0000i  -0.0555 +
0.0000i
  0.0000 + 0.0000i   0.0555 + 0.1110i   0.0000 - 0.1110i  -0.1110 +
0.1110i
  0.0000 + 0.0000i   0.0555 + 0.1110i   0.0000 + 0.1110i   0.1110 +
0.0000i
  0.0000 + 0.0000i   0.0000 - 0.1110i   0.1110 + 0.0000i   0.0000 +
0.1110i
  0.0000 + 0.0000i   0.2220 + 0.0000i   0.0000 + 0.0000i  -0.2220 +
0.0000i
  0.0000 + 0.0000i  -0.1110 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.1110i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0555 - 0.1110i   0.1110 + 0.1110i  -0.1110 -
0.1110i
  0.0000 + 0.0000i   0.1110 - 0.1110i   0.0555 + 0.0000i   0.0555 +
0.0000i

 Columns 5 through 8

  0.1110 + 0.0000i   0.0000 + 0.0000i   0.1110 + 0.0000i   0.1110 +
0.0000i
  0.0000 - 0.1110i   0.0000 + 0.0000i  -0.1110 + 0.1110i   0.0000 -
0.1110i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0555 - 0.1110i  -0.1110 +
0.0000i
  0.0000 + 0.1110i   0.2220 + 0.0000i   0.0000 + 0.0000i   0.1110 +
0.0000i
  0.0000 + 0.1110i  -0.2220 + 0.0000i   0.0000 - 0.1110i   0.0555 +
0.0000i
  0.2220 + 0.0000i   0.0000 + 0.0000i   0.2220 + 0.0000i  -0.2220 +
0.0000i
  0.0000 + 0.0000i  -0.2220 + 0.0000i   0.0000 + 0.1110i   0.0555 +
0.0000i
  0.0555 + 0.0000i   0.2220 + 0.0000i   0.0555 + 0.0000i   0.0000 -
0.1110i
  0.0555 + 0.0000i  -0.2220 + 0.0000i   0.0555 + 0.0000i  -0.1110 +
0.1110i
  0.1110 + 0.1110i   0.2220 + 0.0000i   0.1110 - 0.2220i   0.1110 +
0.1110i

 Columns 9 through 10

  0.0000 + 0.0000i   0.0000 + 0.0000i
  0.0000 + 0.1110i   0.0000 - 0.1110i
 -0.1110 + 0.0000i   0.0555 + 0.0000i
  0.0000 + 0.0000i   0.0555 - 0.1110i
  0.0555 + 0.0000i  -0.1110 + 0.1110i
 -0.2220 + 0.0000i   0.0000 + 0.0000i
  0.0000 + 0.1110i  -0.1110 - 0.1110i
  0.0000 + 0.1110i   0.0000 + 0.0000i
  0.0000 - 0.1110i   0.0000 + 0.1110i
  0.0555 + 0.0000i   0.1110 + 0.0000i
```

```
T12x10 =

     1     0     0     0     0     0     0     0     0     0
     0     0     1     0     1     0     0     0     0     0
     0     0     1     0    -1     0     0     0     0     0
     0     0     0     0     0     1     0     0     0     0
     0     1     0     1     0     0     0     0     0     0
     0     1     0    -1     0     0     0     0     0     0
     0     0     0     0     0     0     0    -1     0     0
     0     0     0     0     0     0     0     0     0     1
     0     0     0     0     0     0     0     1     0     1
     0     0     0     0     0     0    -1     0     0     0
     0     0     0     0     0     0     0     0     1     0
     0     0     0     0     0     0     1     0     1     0


A14x12 =

[ 1,           0,           0, 0,           0,           0,       0,
     0,  0,       0,       0,  0]
[ 0, a1/2 + a2/2,           0, 0,           0,           0,       0,
     0,  0,       0,       0,  0]
[ 0,           0, a1/2 - a2/2, 0,           0,           0,       0,
     0,  0,       0,       0,  0]
[ 0,           0,           1, 0,           0,           0,       0,
     0,  0,       0,       0,  0]
[ 0,           0,           0, 1,           0,           0,       0,
     0,  0,       0,       0,  0]
[ 0,           0,           0, 0, a1/2 + a2/2,           0,       0,
     0,  0,       0,       0,  0]
[ 0,           0,           0, 0,           0, a1/2 - a2/2,       0,
     0,  0,       0,       0,  0]
[ 0,           0,           0, 0,           0,           1,       0,
     0,  0,       0,       0,  0]
[ 0,           0,           0, 0,           0,           0, a3 + a4,
     0,  0,       0,       0,  0]
[ 0,           0,           0, 0,           0,           0,       0,
 a3 - a4,  0,       0,       0,  0]
[ 0,           0,           0, 0,           0,           0,       0,
     0, a4,       0,       0,  0]
[ 0,           0,           0, 0,           0,           0,       0,
     0,  0, a3 + a4,       0,  0]
[ 0,           0,           0, 0,           0,           0,       0,
     0,  0,       0, a3 - a4,  0]
[ 0,           0,           0, 0,           0,           0,       0,
     0,  0,       0,       0, a4]


T10x14 =

  Columns 1 through 13
```

```
    1     0     0     1     0     0     0     0     0     0     0
 0     0
    1     1     1     0     0     0     0     0     0     0     0
 0     0
   -1     1    -1     0     0     0     0     0     0     0     0
 0     0
    0     0     0     0     1     1     1     0     0     0     0
 0     0
    0     0     0     0    -1     1    -1     0     0     0     0
 0     0
    0     0     0     0     1     0     0     1     0     0     0
 0     0
    0     0     0     0     0     0     0     0     1     0     1
 0     0
    0     0     0     0     0     0     0     0     0     1     1
 0     0
    0     0     0     0     0     0     0     0     0     0     0
 1     0
    0     0     0     0     0     0     0     0     0     0     0
 0     1

  Column 14

    0
    0
    0
    0
    0
    0
    0
    0
    1
    1

verification of the algorithm (15)

ans =

[ 0,
                0,
                              0,
                                            0,
                                                          0,
          0,
                        0,
                                      0,
                                                    0,
                                                                  0]
[ 0, a4 - a2 + (910872158600853/1125899906842624
 - 2647149443198255i/4503599627370496),
 a3 - a1 + (347922205179541/1125899906842624 -
 334623263468 37i/35184372088832),      a1 + a3 -
 5566755282872655/18014398509481984 - 334623263468 37i/35184372088832,
   a2 + a4 - 7286977268806825/9007199254740992 -
```

```
 5294298886396511i/9007199254740992,
    0,    a2 - a4 - 3643488634403413/4503599627370496
 + 5294298886396511i/9007199254740992,
 a1 - a3 - 2783377641436329/9007199254740992
 + 8566355544790273i/9007199254740992,
 5566755282872657/18014398509481984 - a3 -
 a1 + 8566355544790275i/9007199254740992,
 3643488634403413/4503599627370496 - a4 - a2 +
 5294298886396513i/9007199254740992]
[ 0,     a3 - a1 + (3479222205179541/1125899906842624
 - 33462326346837i/35184372088832),   a2 +
 a4 - 7286977268806825/9007199254740992 -
 5294298886396511i/9007199254740992,   a2
 - a4 - 3643488634403413/4503599627370496
 + 5294298886396511i/9007199254740992,
 5566755282872657/18014398509481984 - a3 - a1 +
 8566355544790275i/9007199254740992,  1i/18014398509481984,
  a3 - a1 + (1391688820718165/4503599627370496
 - 21415888861975691/2251799813685248),
 a2 + a4 - 1821744317201707/2251799813685248
 - 2647149443198257i/4503599627370496,   a2
 - a4 - 3643488634403415/4503599627370496
 + 2647149443198257i/4503599627370496,
 1391688820718165/4503599627370496 - a3 - a1 +
 8566355544790279i/9007199254740992]
[ 0,     a1 + a3 - 5566755282872655/18014398509481984
 - 33462326346837i/35184372088832,   a2
 - a4 - 3643488634403413/4503599627370496
 + 5294298886396511i/9007199254740992,
 3643488634403413/4503599627370496 - a4 - a2
 + 5294298886396513i/9007199254740992, a3 -
 a1 + (1391688820718165/4503599627370496 -
 21415888861975691/2251799813685248), -3i/18014398509481984,
    1391688820718165/4503599627370496 - a3 -
 a1 + 8566355544790279i/9007199254740992,
 a4 - a2 + (455436079300427/562949953421312 -
 5294298886396515i/9007199254740992),     a2 + a4 -
 455436079300427/562949953421312 - 2647149443198259i/4503599627370496,
  a1 - a3 - 5566755282872665/18014398509481984 +
 42831777723951411/4503599627370496]
[ 0,  a2 + a4 - 7286977268806825/9007199254740992
 - 5294298886396511i/9007199254740992,
 5566755282872657/18014398509481984 - a3 -
 a1 + 8566355544790275i/9007199254740992, a3
 - a1 + (1391688820718165/4503599627370496
 - 21415888861975691/2251799813685248),   a2
 - a4 - 3643488634403415/4503599627370496 +
 2647149443198257i/4503599627370496,  1i/18014398509481984,
      a2 + a4 - 455436079300427/562949953421312
 - 2647149443198259i/4503599627370496,
 5566755282872661/18014398509481984 - a3 -
 a1 + 8566355544790283i/9007199254740992, a3
 - a1 + (2783377641436333/9007199254740992
 - 8566355544790285i/9007199254740992),   a2
```

```
 - a4 - 3643488634403419/4503599627370496 +
 5294298886396519i/9007199254740992]
[ 0,
                0,
             1i/18014398509481984,
                           -3i/18014398509481984,
                                                  1i/18014398509481984,
 -3i/18014398509481984,
                        1i/9007199254740992,
                                               -1i/9007199254740992,

 1i/9007199254740992,
              -1i/9007199254740992]
[ 0,  a2 - a4 - 3643488634403413/4503599627370496
 + 5294298886396511i/9007199254740992, a3
 - a1 + (1391688820718165/4503599627370496
 - 21415888861975691/2251799813685248),
 1391688820718165/4503599627370496 - a3 - a1 +
 85663555447902791/9007199254740992,     a2 + a4 -
 455436079300427/562949953421312 - 26471494431982591/4503599627370496,
   1i/9007199254740992,    a2 - a4 - 3643488634403419/4503599627370496
 + 5294298886396519i/9007199254740992, a3
 - a1 + (5566755282872669/18014398509481984
 - 8566355544790289i/9007199254740992),
 1391688820718167/4503599627370496 - a3 - a1
 + 8566355544790293i/9007199254740992,   a2
 + a4 - 3643488634403421/4503599627370496 -
 26471494431982631/4503599627370496]
[ 0,  a1 - a3 - 2783377641436329/9007199254740992
 + 8566355544790273i/9007199254740992,   a2
 + a4 - 1821744317201707/2251799813685248
 - 2647149443198257i/4503599627370496,
 a4 - a2 + (455436079300427/562949953421312
 - 5294298886396515i/9007199254740992),
 5566755282872661/18014398509481984 - a3 - a1 +
 85663555447902831/9007199254740992,  -1i/9007199254740992,
 a3 - a1 + (5566755282872669/18014398509481984
 - 8566355544790289i/9007199254740992),
 910872158600855/1125899906842624 - a4 - a2
 + 13235747215991311/2251799813685248,   a2
 - a4 - 3643488634403423/4503599627370496
 + 13235747215991311/2251799813685248,   a1
 + a3 - 1391688820718167/4503599627370496 -
 85663555447902991/9007199254740992]
[ 0, 5566755282872657/18014398509481984 - a3
 - a1 + 8566355544790275i/9007199254740992,
 a2 - a4 - 3643488634403415/4503599627370496 +
 2647149443198257i/4503599627370496,     a2 + a4 -
 455436079300427/562949953421312 - 26471494431982591/4503599627370496,
 a3 - a1 + (2783377641436333/9007199254740992 -
 8566355544790285i/9007199254740992),   1i/9007199254740992,
    1391688820718167/4503599627370496 - a3 -
 a1 + 8566355544790293i/9007199254740992,
 a2 - a4 - 3643488634403423/4503599627370496 +
```

```
 1323574721599131i/2251799813685248,     a2 + a4 -
 7286977268806847/9007199254740992 - 3308936803997831/562949953421312,
 a3 - a1 + (2783377641436339/9007199254740992 -
 8566355544790303i/9007199254740992)]
[ 0,  3643488634403413/4503599627370496 - a4
 - a2 + 5294298886396513i/9007199254740992,
   1391688820718165/4503599627370496 - a3 -
 a1 + 8566355544790279i/9007199254740992,  a1
 - a3 - 5566755282872665/18014398509481984
 + 4283177772395141i/4503599627370496,   a2
 - a4 - 3643488634403419/4503599627370496 +
 5294298886396519i/9007199254740992,  -1i/9007199254740992,
    a2 + a4 - 3643488634403421/4503599627370496
 - 2647149443198263i/4503599627370496,
 a1 + a3 - 1391688820718167/4503599627370496
 - 8566355544790299i/9007199254740992, a3 -
 a1 + (2783377641436339/9007199254740992 -
 8566355544790303i/9007199254740992), a4 -
 a2 + (3643488634403427/4503599627370496 -
 2647149443198265i/4503599627370496)]


imag=1i
a1=cos(2*pi/5)
a2 = cos(pi/5)
a3 = imag*sin(2*pi/5)
a4 = imag*sin(pi/5)

A14x12=[1 0 0 0 0 0 0 0 0 0 0 0;
     0 (a1+a2)/2 0 0 0 0 0 0 0 0 0 0;
     0 0 (a1-a2)/2 0 0 0 0 0 0 0 0 0;
     0 0 1 0 0 0 0 0 0 0 0 0;
     0 0 0 1 0 0 0 0 0 0 0 0;
     0 0 0 0 (a1+a2)/2 0 0 0 0 0 0 0;
     0 0 0 0 0 (a1-a2)/2 0 0 0 0 0 0;
     0 0 0 0 0 1 0 0 0 0 0 0;
     0 0 0 0 0 0 a3+a4 0 0 0 0 0;
     0 0 0 0 0 0 0 a3-a4 0 0 0 0;
     0 0 0 0 0 0 0 0 a4 0 0 0;
     0 0 0 0 0 0 0 0 0 a3+a4 0 0;
     0 0 0 0 0 0 0 0 0 0 a3-a4 0;
     0 0 0 0 0 0 0 0 0 0 0 a4]

display('verification of the algorithm (15) for real values')
display(W10 - V10*V10h*S10r*T10x14*A14x12*T12x10*S10c*V10)


imag =

   0.0000 + 1.0000i


a1 =
```

```
    0.3090

a2 =

    0.8090

a3 =

   0.0000 + 0.9511i

a4 =

   0.0000 + 0.5878i

A14x12 =

  Columns 1 through 4

   1.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.5590 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i  -0.2500 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   1.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   1.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i

  Columns 5 through 8
```

```
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.5590 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i  -0.2500 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   1.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 1.5388i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.3633i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i

 Columns 9 through 12

  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  0.0000 + 0.5878i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
```

```
   0.0000 + 0.0000i   0.0000 + 1.5388i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.3633i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.5878i

verification of the algorithm (15) for real values
   1.0e-14 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 - 0.0111i   0.0056 -
0.0222i
   0.0000 + 0.0000i   0.0000 - 0.0111i  -0.0111 - 0.0111i  -0.0222 +
0.0111i
   0.0000 + 0.0000i   0.0056 - 0.0111i  -0.0222 + 0.0111i   0.0222 +
0.0333i
   0.0000 + 0.0000i  -0.0111 - 0.0111i   0.0056 + 0.0444i   0.0222 -
0.0666i
   0.0000 + 0.0000i  -0.0222 + 0.0000i   0.0444 + 0.0056i  -0.0666 -
0.0167i
   0.0000 + 0.0000i  -0.0222 + 0.0111i   0.0222 - 0.0555i   0.0222 +
0.0999i
   0.0000 + 0.0000i  -0.0111 + 0.0222i  -0.0444 - 0.0444i   0.0888 -
0.0555i
   0.0000 + 0.0000i   0.0056 + 0.0444i  -0.0666 + 0.0444i  -0.0888 -
0.0888i
   0.0000 + 0.0000i   0.0222 + 0.0333i   0.0222 + 0.0888i  -0.0500 +
0.1332i

  Columns 5 through 8

   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
0.0000i
  -0.0111 - 0.0111i  -0.0222 + 0.0000i  -0.0222 + 0.0111i  -0.0111 +
0.0333i
   0.0056 + 0.0555i   0.0444 + 0.0056i   0.0222 - 0.0666i  -0.0444 -
0.0444i
   0.0222 - 0.0666i  -0.0666 - 0.0167i   0.0222 + 0.0999i   0.0888 -
0.0555i
  -0.0666 + 0.0444i   0.0888 + 0.0056i  -0.0888 - 0.0888i   0.0278 +
0.1443i
   0.0888 + 0.0056i  -0.1332 - 0.0167i   0.1332 + 0.0111i  -0.1554 -
0.0111i
  -0.0888 - 0.0888i   0.1332 + 0.0111i  -0.1554 + 0.0999i   0.0722 -
0.2109i
   0.0278 + 0.1443i  -0.1554 - 0.0111i   0.0722 - 0.2109i   0.1776 +
0.1554i
   0.0555 - 0.1665i   0.1998 + 0.0111i   0.0666 + 0.2554i  -0.2442 +
0.1554i
```

```
  -0.1554 + 0.0999i  -0.2220 - 0.0111i  -0.1998 - 0.1776i  -0.0666 -
0.3220i

  Columns 9 through 10

   0.0000 + 0.0000i   0.0000 + 0.0000i
   0.0056 + 0.0444i   0.0222 + 0.0333i
  -0.0666 + 0.0444i   0.0222 + 0.0888i
  -0.0888 - 0.0888i  -0.0500 + 0.1221i
   0.0555 - 0.1554i  -0.1554 + 0.0999i
   0.1998 + 0.0111i  -0.2220 - 0.0111i
   0.0666 + 0.2442i  -0.1998 - 0.1776i
  -0.2442 + 0.1554i  -0.0666 - 0.3109i
  -0.2554 - 0.1998i   0.1221 - 0.3553i
   0.1221 - 0.3553i   0.3331 - 0.2220i
```

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