In[311]:=
```
pppp = Table[0, {i, 5}]
          tabela
pppm = Table[0, {i, 5}]
          tabela
ppmm = Table[0, {i, 5}]
          tabela
pmmm = Table[0, {i, 5}]
          tabela
mmmm = Table[0, {i, 5}]
          tabela
pppp[[1]] := 1
pppm[[2]] := 1
ppmm[[3]] := 1
pmmm[[4]] := 1
mmmm[[5]] := 1

Jp = Table[0, {i, 5}, {k, 5}]
        tabela
Jm = Table[0, {i, 5}, {k, 5}]
        tabela

Jx = Table[0, {i, 5}, {k, 5}]
        tabela
Jy = Table[0, {i, 5}, {k, 5}]
        tabela
Jz = Table[0, {i, 5}, {k, 5}]
        tabela

Jp[[1, 2]] := Sqrt[4]
              pierwiastek kwadratowy
Jp[[2, 3]] := Sqrt[6]
              pierwiastek kwadratowy
Jp[[3, 4]] := Sqrt[6]
              pierwiastek kwadratowy
Jp[[4, 5]] := Sqrt[4]
              pierwiastek kwadratowy
MatrixForm[Jp]
postać macierzy
Jm[[2, 1]] := Sqrt[4]
              pierwiastek kwadratowy
Jm[[3, 2]] := Sqrt[6]
              pierwiastek kwadratowy
Jm[[4, 3]] := Sqrt[6]
              pierwiastek kwadratowy
Jm[[5, 4]] := Sqrt[4]
              pierwiastek kwadratowy
MatrixForm[Jm]
postać macierzy
Jx = (Jp + Jm) / 2
"Macierz Jx"
```

```
MatrixForm[Jx]
postać macierzy
Jy = ⅈ * (-Jp + Jm) / 2
"Macierz Jy"
MatrixForm[Jy]
postać macierzy
Jz = ⅈ * (-Jx.Jy + Jy.Jx)
"Macierz Jz"
MatrixForm[Jz]
postać macierzy
Eigenvectors[Jx]
wektory własne
MatrixForm[Eigenvalues[Jx]]
postać macie·· wartości własne macierzy
Eigenvectors[Jy]
wektory własne
MatrixForm[Eigenvalues[Jy]]
postać macie·· wartości własne macierzy
Eigenvectors[Jz]
wektory własne
MatrixForm[Eigenvalues[Jz]]
postać macie·· wartości własne macierzy
"Macierz obrotu o kat T"
R = FullSimplify[MatrixExp[- ⅈ T Jy]]
    uprość pełniej      eksponenta macierzy
MatrixForm[R]
postać macierzy
"Wektory macierzy dij"
R1 = R[[All, 1]]
        wszystko
R2 = R[[All, 2]]
        wszystko
R3 = R[[All, 3]]
        wszystko
R4 = R[[All, 4]]
        wszystko
R5 = R[[All, 5]]
        wszystko
MatrixForm[R1]
postać macierzy
MatrixForm[R2]
postać macierzy
MatrixForm[R3]
postać macierzy
MatrixForm[R4]
postać macierzy
MatrixForm[R5]
postać macierzy
"Orthogonality"
Simplify[R1[[1]] * R2[[1]] + R1[[2]] * R2[[2]] +
uprość
```

```
uprość
  R1[[3]] * R2[[3]] + R1[[4]] * R2[[4]] + R1[[5]] * R2[[5]]]
Simplify[R1[[1]] * R3[[1]] + R1[[2]] * R3[[2]] + R1[[3]] * R3[[3]] +
uprość
  R1[[4]] * R3[[4]] + R1[[5]] * R3[[5]]]
Simplify[R1[[1]] * R4[[1]] + R1[[2]] * R4[[2]] + R1[[3]] * R4[[3]] +
uprość
  R1[[4]] * R4[[4]] + R1[[5]] * R4[[5]]]
Simplify[R1[[1]] * R5[[1]] + R1[[2]] * R5[[2]] + R1[[3]] * R5[[3]] +
uprość
  R1[[4]] * R5[[4]] + R1[[5]] * R5[[5]]]
Simplify[R2[[1]] * R3[[1]] + R2[[2]] * R3[[2]] + R2[[3]] * R3[[3]] +
uprość
  R2[[4]] * R3[[4]] + R2[[5]] * R3[[5]]]
Simplify[R2[[1]] * R4[[1]] + R2[[2]] * R4[[2]] + R2[[3]] * R4[[3]] +
uprość
  R2[[4]] * R4[[4]] + R2[[5]] * R4[[5]]]
Simplify[R2[[1]] * R5[[1]] + R2[[2]] * R5[[2]] + R2[[3]] * R5[[3]] +
uprość
  R2[[4]] * R5[[4]] + R2[[5]] * R5[[5]]]
Simplify[R3[[1]] * R4[[1]] + R3[[2]] * R4[[2]] + R3[[3]] * R4[[3]] +
uprość
  R3[[4]] * R4[[4]] + R3[[5]] * R4[[5]]]
Simplify[R3[[1]] * R5[[1]] + R3[[2]] * R5[[2]] + R3[[3]] * R5[[3]] +
uprość
  R3[[4]] * R5[[4]] + R3[[5]] * R5[[5]]]
Simplify[R4[[1]] * R5[[1]] + R4[[2]] * R5[[2]] + R4[[3]] * R5[[3]] +
uprość
  R4[[4]] * R5[[4]] + R4[[5]] * R5[[5]]]
"Orthonormal"
Simplify[R1[[1]] * R1[[1]] + R1[[2]] * R1[[2]] +
uprość
  R1[[3]] * R1[[3]] + R1[[4]] * R1[[4]] + R1[[5]] * R1[[5]]]
Simplify[R2[[1]] * R2[[1]] + R2[[2]] * R2[[2]] + R2[[3]] * R2[[3]] +
uprość
  R2[[4]] * R2[[4]] + R2[[5]] * R2[[5]]]
Simplify[R3[[1]] * R3[[1]] + R3[[2]] * R3[[2]] + R3[[3]] * R3[[3]] +
uprość
  R3[[4]] * R3[[4]] + R3[[5]] * R3[[5]]]
Simplify[R4[[1]] * R4[[1]] + R4[[2]] * R4[[2]] + R4[[3]] * R4[[3]] +
uprość
  R4[[4]] * R4[[4]] + R4[[5]] * R4[[5]]]
Simplify[R5[[1]] * R5[[1]] + R5[[2]] * R5[[2]] + R5[[3]] * R5[[3]] +
uprość
  R5[[4]] * R5[[4]] + R5[[5]] * R5[[5]]]
"Wartośći dij*dij"
```

$$\int_0^{\pi} R[[1, 1]]\, R[[1, 1]]\, \mathrm{Sin}[T] / 2 \, dT$$

sinus

```
For[i = 1;
dla
```

```
  t = x, i < 6, i++, t = ∫_0^π R[[1, i]] R[[1, i]] Sin[T] / 2 dT;
                                                 sinus
  Print[t]]
  drukuj
For[i = 1;
dla
  t = x, i < 6, i++, t = ∫_0^π R[[2, i]] R[[2, i]] Sin[T] / 2 dT;
                                                 sinus
  Print[t]]
  drukuj
For[i = 1;
dla
  t = x, i < 6, i++, t = ∫_0^π R[[3, i]] R[[3, i]] Sin[T] / 2 dT;
                                                 sinus
  Print[t]]
  drukuj
For[i = 1;
dla
  t = x, i < 6, i++, t = ∫_0^π R[[4, i]] R[[4, i]] Sin[T] / 2 dT;
                                                 sinus
  Print[t]]
  drukuj
For[i = 1;
dla
  t = x, i < 6, i++, t = ∫_0^π R[[5, i]] R[[5, i]] Sin[T] / 2 dT;
                                                 sinus
  Print[t]]
  drukuj
"Równania Maxwella"
M = Sin[T] * Jx + Cos[T] * Jz
    sinus        cosinus
MatrixForm[M]
postać macierzy
eigenvectorQ[matrix_, vector_] := MatrixRank[{matrix.vector, vector}] == 1
                                  rząd macierzy
"Sprawdzanie czy wektor jest wektorem własnym danej macierzy"
eigenvectorQ[M, R1]
eigenvectorQ[M, R2]
eigenvectorQ[M, R3]
eigenvectorQ[M, R4]
eigenvectorQ[M, R5]
```

```
MatrixForm[Eigenvalues[M]]
          wartości własne macierzy
FullSimplify[MatrixForm[M.R1 - 2 R1]]
            postać macierzy
FullSimplify[MatrixForm[M.R2 - R2]]
            postać macierzy
FullSimplify[MatrixForm[M.R3]]
            postać macierzy
FullSimplify[MatrixForm[M.R4 + R4]]
            postać macierzy
FullSimplify[MatrixForm[M.R5 + 2 R5]]
            postać macierzy
"Czyli warotści włąsne to kolejno[ 2,1,0,-1,-2]"
"..."
"Pchnięcia Y"
PAY = FullSimplify[MatrixExp[ w Jy]]
      uprość pełniej  eksponenta macierzy
MatrixForm[PAY]
postać macierzy
"Kolumny macierzy obrotu o Y"
PAY1 = PAY[[All, 1]]
           wszystko
PAY2 = PAY[[All, 2]]
           wszystko
PAY3 = PAY[[All, 3]]
           wszystko
PAY4 = PAY[[All, 4]]
           wszystko
PAY5 = PAY[[All, 5]]
           wszystko
"Ortogonalność"
Simplify[PAY1[[1]] * PAY2[[5]] - PAY1[[2]] * PAY2[[4]] +
uprość
  PAY1[[3]] * PAY2[[3]] - PAY1[[4]] * PAY2[[2]] + PAY1[[5]] * PAY2[[1]]]
Simplify[PAY1[[1]] * PAY3[[5]] - PAY1[[2]] * PAY3[[4]] +
uprość
  PAY1[[3]] * PAY3[[3]] - PAY1[[4]] * PAY3[[2]] + PAY1[[5]] * PAY3[[1]]]
Simplify[PAY1[[1]] * PAY4[[5]] - PAY1[[2]] * PAY4[[4]] +
uprość
  PAY1[[3]] * PAY4[[3]] - PAY1[[4]] * PAY4[[2]] + PAY1[[5]] * PAY4[[1]]]
Simplify[PAY1[[1]] * PAY5[[5]] - PAY1[[2]] * PAY5[[4]] +
uprość
  PAY1[[3]] * PAY5[[3]] - PAY1[[4]] * PAY5[[2]] + PAY1[[5]] * PAY5[[1]]]
Simplify[PAY2[[1]] * PAY3[[5]] - PAY2[[2]] * PAY3[[4]] +
uprość
  PAY2[[3]] * PAY3[[3]] - PAY2[[4]] * PAY3[[2]] + PAY2[[5]] * PAY3[[1]]]
Simplify[PAY2[[1]] * PAY4[[5]] - PAY2[[2]] * PAY4[[4]] +
uprość
  PAY2[[3]] * PAY4[[3]] - PAY2[[4]] * PAY4[[2]] + PAY2[[5]] * PAY4[[1]]]
Simplify[PAY2[[1]] * PAY5[[5]] - PAY2[[2]] * PAY5[[4]] +
uprość
```

```
  PAY2[[3]] * PAY5[[3]] - PAY2[[4]] * PAY5[[2]] + PAY2[[5]] * PAY5[[1]]]
Simplify[PAY3[[1]] * PAY4[[5]] - PAY3[[2]] * PAY4[[4]] +
uprość
  PAY3[[3]] * PAY4[[3]] - PAY3[[4]] * PAY4[[2]] + PAY3[[5]] * PAY4[[1]]]
Simplify[PAY3[[1]] * PAY5[[5]] - PAY3[[2]] * PAY5[[4]] +
uprość
  PAY3[[3]] * PAY5[[3]] - PAY3[[4]] * PAY5[[2]] + PAY3[[5]] * PAY5[[1]]]
Simplify[PAY4[[1]] * PAY5[[5]] - PAY4[[2]] * PAY5[[4]] +
uprość
  PAY4[[3]] * PAY5[[3]] - PAY4[[4]] * PAY5[[2]] + PAY4[[5]] * PAY5[[1]]]
"Normalizacja"
Simplify[PAY1[[1]] * PAY1[[1]] + PAY1[[2]] * PAY1[[2]] +
uprość
  PAY1[[3]] * PAY1[[3]] + PAY1[[4]] * PAY1[[4]] + PAY1[[5]] * PAY1[[5]]]
Simplify[PAY2[[1]] * PAY2[[1]] + PAY2[[2]] * PAY2[[2]] +
uprość
  PAY2[[3]] * PAY2[[3]] + PAY2[[4]] * PAY2[[4]] + PAY2[[5]] * PAY2[[5]]]
Simplify[PAY3[[1]] * PAY3[[1]] + PAY3[[2]] * PAY3[[2]] +
uprość
  PAY3[[3]] * PAY3[[3]] + PAY3[[4]] * PAY3[[4]] + PAY3[[5]] * PAY3[[5]]]
Simplify[PAY4[[1]] * PAY4[[1]] + PAY4[[2]] * PAY4[[2]] +
uprość
  PAY4[[3]] * PAY4[[3]] + PAY4[[4]] * PAY4[[4]] + PAY4[[5]] * PAY4[[5]]]
Simplify[PAY5[[1]] * PAY5[[1]] + PAY5[[2]] * PAY5[[2]] +
uprość
  PAY5[[3]] * PAY5[[3]] + PAY5[[4]] * PAY5[[4]] + PAY5[[5]] * PAY5[[5]]]
"Macierz strorzona z iloczynu wektorów"
LAY = Table[0, {i, 5}, {k, 5}]
      tabela
LAY[[1, 5]] := 1
LAY[[5, 1]] := 1
LAY[[4, 2]] := -1
LAY[[2, 4]] := -1
MatrixForm[LAY]
postać macierzy
"Pchniecie znalezionej macierzy Y i X"
MatrixForm[PAY.LAY]
postać macierzy
MatrixForm[PAX.LAY]
postać macierzy
"Pchniecie wektórw własnych znalezionej macierzy Y i X"
MatrixForm[PAY.Eigenvectors[LAY]]
                wektory własne
MatrixForm[PAX.Eigenvectors[LAY]]
                wektory własne
"Pchnięcia X"
PAX = FullSimplify[MatrixExp[w Jx]]
      uprość pełniej  eksponenta macierzy
MatrixForm[PAX]
postać macierzy
```

```
postać macierzy
"Kolumny macierzy obrotu o X"
PAX1 = PAX[[All, 1]]
           wszystko
PAX2 = PAX[[All, 2]]
           wszystko
PAX3 = PAX[[All, 3]]
           wszystko
PAX4 = PAX[[All, 4]]
           wszystko
PAX5 = PAX[[All, 5]]
           wszystko
"Ortogonalność"
Simplify[PAX1[[1]] * PAX2[[5]] - PAX1[[2]] * PAX2[[4]] +
uprość
  PAX1[[3]] * PAX2[[3]] - PAX1[[4]] * PAX2[[2]] + PAX1[[5]] * PAX2[[1]]]
Simplify[PAX1[[1]] * PAX3[[5]] - PAX1[[2]] * PAX3[[4]] +
uprość
  PAX1[[3]] * PAX3[[3]] - PAX1[[4]] * PAX3[[2]] + PAX1[[5]] * PAX3[[1]]]
Simplify[PAX1[[1]] * PAX4[[5]] - PAX1[[2]] * PAX4[[4]] +
uprość
  PAX1[[3]] * PAX4[[3]] - PAX1[[4]] * PAX4[[2]] + PAX1[[5]] * PAX4[[1]]]
Simplify[PAX1[[1]] * PAX5[[5]] - PAX1[[2]] * PAX5[[4]] +
uprość
  PAX1[[3]] * PAX5[[3]] - PAX1[[4]] * PAX5[[2]] + PAX1[[5]] * PAX5[[1]]]
Simplify[PAX2[[1]] * PAX3[[5]] - PAX2[[2]] * PAX3[[4]] +
uprość
  PAX2[[3]] * PAX3[[3]] - PAX2[[4]] * PAX3[[2]] + PAX2[[5]] * PAX3[[1]]]
Simplify[PAX2[[1]] * PAX4[[5]] - PAX2[[2]] * PAX4[[4]] +
uprość
  PAX2[[3]] * PAX4[[3]] - PAX2[[4]] * PAX4[[2]] + PAX2[[5]] * PAX4[[1]]]
Simplify[PAX2[[1]] * PAX5[[5]] - PAX2[[2]] * PAX5[[4]] +
uprość
  PAX2[[3]] * PAX5[[3]] - PAX2[[4]] * PAX5[[2]] + PAX2[[5]] * PAX5[[1]]]
Simplify[PAX3[[1]] * PAX4[[5]] - PAX3[[2]] * PAX4[[4]] +
uprość
  PAX3[[3]] * PAX4[[3]] - PAX3[[4]] * PAX4[[2]] + PAX3[[5]] * PAX4[[1]]]
Simplify[PAX3[[1]] * PAX5[[5]] - PAX3[[2]] * PAX5[[4]] +
uprość
  PAX3[[3]] * PAX5[[3]] - PAX3[[4]] * PAX5[[2]] + PAX3[[5]] * PAX5[[1]]]
Simplify[PAX4[[1]] * PAX5[[5]] - PAX4[[2]] * PAX5[[4]] +
uprość
  PAX4[[3]] * PAX5[[3]] - PAX4[[4]] * PAX5[[2]] + PAX4[[5]] * PAX5[[1]]]
"Sprawdzenie czy dla pchnięcia w X była by taka sama macierz, jak widać TAK"
```

Out[311]= {0, 0, 0, 0, 0}

Out[312]= {0, 0, 0, 0, 0}

Out[313]= {0, 0, 0, 0, 0}

Out[314]= {0, 0, 0, 0, 0}

Out[315]= $\{0, 0, 0, 0, 0\}$

Out[321]= $\{\{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}\}$

Out[322]= $\{\{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}\}$

Out[323]= $\{\{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}\}$

Out[324]= $\{\{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}\}$

Out[325]= $\{\{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0\}\}$

Out[330]//MatrixForm=

$$\begin{pmatrix} 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & \sqrt{6} & 0 & 0 \\ 0 & 0 & 0 & \sqrt{6} & 0 \\ 0 & 0 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Out[335]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 2 & 0 & 0 & 0 & 0 \\ 0 & \sqrt{6} & 0 & 0 & 0 \\ 0 & 0 & \sqrt{6} & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 \end{pmatrix}$$

Out[336]= $\left\{\{0, 1, 0, 0, 0\}, \left\{1, 0, \sqrt{\frac{3}{2}}, 0, 0\right\}, \left\{0, \sqrt{\frac{3}{2}}, 0, \sqrt{\frac{3}{2}}, 0\right\}, \left\{0, 0, \sqrt{\frac{3}{2}}, 0, 1\right\}, \{0, 0, 0, 1, 0\}\right\}$

Out[337]= Macierz Jx

Out[338]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & \sqrt{\frac{3}{2}} & 0 & 0 \\ 0 & \sqrt{\frac{3}{2}} & 0 & \sqrt{\frac{3}{2}} & 0 \\ 0 & 0 & \sqrt{\frac{3}{2}} & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Out[339]= $\left\{\{0, -i, 0, 0, 0\}, \left\{i, 0, -i\sqrt{\frac{3}{2}}, 0, 0\right\},\right.$
$\left.\left\{0, i\sqrt{\frac{3}{2}}, 0, -i\sqrt{\frac{3}{2}}, 0\right\}, \left\{0, 0, i\sqrt{\frac{3}{2}}, 0, -i\right\}, \{0, 0, 0, i, 0\}\right\}$

Out[340]= Macierz Jy

Out[341]//MatrixForm=

$$\begin{pmatrix} 0 & -i & 0 & 0 & 0 \\ i & 0 & -i\sqrt{\frac{3}{2}} & 0 & 0 \\ 0 & i\sqrt{\frac{3}{2}} & 0 & -i\sqrt{\frac{3}{2}} & 0 \\ 0 & 0 & i\sqrt{\frac{3}{2}} & 0 & -i \\ 0 & 0 & 0 & i & 0 \end{pmatrix}$$

Out[342]= $\{\{2, 0, 0, 0, 0\}, \{0, 1, 0, 0, 0\}, \{0, 0, 0, 0, 0\}, \{0, 0, 0, -1, 0\}, \{0, 0, 0, 0, -2\}\}$

Out[343]= Macierz Jz

Out[344]//MatrixForm=

$$\begin{pmatrix} 2 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 & -2 \end{pmatrix}$$

Out[345]= $\left\{\left\{1, -2, \sqrt{6}, -2, 1\right\}, \left\{1, 2, \sqrt{6}, 2, 1\right\}, \{-1, 1, 0, -1, 1\}, \{-1, -1, 0, 1, 1\}, \left\{1, 0, -\sqrt{\frac{2}{3}}, 0, 1\right\}\right\}$

Out[346]//MatrixForm=

$$\begin{pmatrix} -2 \\ 2 \\ -1 \\ 1 \\ 0 \end{pmatrix}$$

Out[347]= $\left\{\left\{1, -2i, -\sqrt{6}, 2i, 1\right\}, \left\{1, 2i, -\sqrt{6}, -2i, 1\right\}, \{-1, i, 0, i, 1\}, \{-1, -i, 0, -i, 1\}, \left\{1, 0, \sqrt{\frac{2}{3}}, 0, 1\right\}\right\}$

Out[348]//MatrixForm=

$$\begin{pmatrix} -2 \\ 2 \\ -1 \\ 1 \\ 0 \end{pmatrix}$$

Out[349]= $\{\{0, 0, 0, 0, 1\}, \{1, 0, 0, 0, 0\}, \{0, 0, 0, 1, 0\}, \{0, 1, 0, 0, 0\}, \{0, 0, 1, 0, 0\}\}$

Out[350]//MatrixForm=

$$\begin{pmatrix} -2 \\ 2 \\ -1 \\ 1 \\ 0 \end{pmatrix}$$

Out[351]= Macierz obrotu o kat T

Out[352]= $\left\{\left\{\mathrm{Cos}\left[\frac{T}{2}\right]^4, -2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3 \mathrm{Sin}\left[\frac{T}{2}\right], \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2, -\mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T], \mathrm{Sin}\left[\frac{T}{2}\right]^4\right\},\right.$

$\left\{\frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T], \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right), -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T],\right.$

$\left.\frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right), -\mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T]\right\}, \left\{\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2, \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T],\right.$

$\left.\frac{1}{4}\left(1+3\,\mathrm{Cos}[2T]\right), -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T], \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2\right\}, \left\{\mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T],\right.$

$\left.\frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right), \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T], \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right), -2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3\mathrm{Sin}\left[\frac{T}{2}\right]\right\},$

$\left.\left\{\mathrm{Sin}\left[\frac{T}{2}\right]^4, \mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T], \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2, \frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T], \mathrm{Cos}\left[\frac{T}{2}\right]^4\right\}\right\}$

Out[353]//MatrixForm=

$$\left(\begin{array}{ccccc}
\mathrm{Cos}\left[\frac{T}{2}\right]^4 & -2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3\mathrm{Sin}\left[\frac{T}{2}\right] & \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2 & -\mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T] & \mathrm{Si} \\
\frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T] & \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right) & -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] & \frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right) & -\mathrm{Sin}[\\
\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2 & \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] & \frac{1}{4}\left(1+3\,\mathrm{Cos}[2T]\right) & -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] & \frac{1}{2}\sqrt{\frac{3}{2}} \\
\mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T] & \frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right) & \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] & \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right) & -2\,\mathrm{Cos}[\\
\mathrm{Sin}\left[\frac{T}{2}\right]^4 & \mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T] & \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2 & \frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T] & \mathrm{Cc}
\end{array}\right.$$

Out[354]= Wektory macierzy dij

Out[355]= $\left\{\mathrm{Cos}\left[\frac{T}{2}\right]^4, \frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T], \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2, \mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T], \mathrm{Sin}\left[\frac{T}{2}\right]^4\right\}$

Out[356]= $\left\{-2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3\mathrm{Sin}\left[\frac{T}{2}\right], \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right),\right.$

$\left.\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T], \frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right), \mathrm{Sin}\left[\frac{T}{2}\right]^2\mathrm{Sin}[T]\right\}$

Out[357]= $\left\{\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2, -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T], \frac{1}{4}\left(1+3\,\mathrm{Cos}[2T]\right), \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T], \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2\right\}$

Out[358]= $\left\{-\mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T], \frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right), -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T], \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right), \frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T]\right\}$

Out[359]= $\left\{\mathrm{Sin}\left[\frac{T}{2}\right]^4, -\mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T], \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2, -2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3 \mathrm{Sin}\left[\frac{T}{2}\right], \mathrm{Cos}\left[\frac{T}{2}\right]^4\right\}$

Out[360]//MatrixForm=

$$\begin{pmatrix} \mathrm{Cos}\left[\frac{T}{2}\right]^4 \\ \frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T] \\ \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2 \\ \mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T] \\ \mathrm{Sin}\left[\frac{T}{2}\right]^4 \end{pmatrix}$$

Out[361]//MatrixForm=

$$\begin{pmatrix} -2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3 \mathrm{Sin}\left[\frac{T}{2}\right] \\ \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right) \\ \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] \\ \frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right) \\ \mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T] \end{pmatrix}$$

Out[362]//MatrixForm=

$$\begin{pmatrix} \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2 \\ -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] \\ \frac{1}{4}\left(1+3\,\mathrm{Cos}[2T]\right) \\ \sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] \\ \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sin}[T]^2 \end{pmatrix}$$

Out[363]//MatrixForm=

$$\begin{pmatrix} -\mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T] \\ \frac{1}{2}\left(\mathrm{Cos}[T]-\mathrm{Cos}[2T]\right) \\ -\sqrt{\frac{3}{2}}\,\mathrm{Cos}[T]\,\mathrm{Sin}[T] \\ \frac{1}{2}\left(\mathrm{Cos}[T]+\mathrm{Cos}[2T]\right) \\ \frac{1}{2}\left(1+\mathrm{Cos}[T]\right)\mathrm{Sin}[T] \end{pmatrix}$$

Out[364]//MatrixForm=

$$\begin{pmatrix} \mathrm{Sin}\left[\frac{T}{2}\right]^4 \\ -\mathrm{Sin}\left[\frac{T}{2}\right]^2 \mathrm{Sin}[T] \\ \frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sin}[T]^2 \\ -2\,\mathrm{Cos}\left[\frac{T}{2}\right]^3 \mathrm{Sin}\left[\frac{T}{2}\right] \\ \mathrm{Cos}\left[\frac{T}{2}\right]^4 \end{pmatrix}$$

Out[365]= Orthogonality

Out[366]= 0

Out[367]= 0

Out[368]= 0

Out[369]= 0

Out[370]= 0

Out[371]= 0

Out[372]= 0

Out[373]= 0

Out[374]= 0

Out[375]= 0

Out[376]= Orthonormal

Out[377]= 1

Out[378]= 1

Out[379]= 1

Out[380]= 1

Out[381]= 1

Out[382]= Wartośći dij*dij

Out[383]= $\frac{1}{5}$

$\frac{1}{5}$

$\frac{1}{5}$

$\frac{1}{5}$

$\frac{1}{5}$

$\frac{1}{5}$

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$\frac{1}{5}$

$\frac{1}{5}$

Out[389]= Równania Maxwella

Out[390]= $\left\{\{2\,\mathrm{Cos}[T], \mathrm{Sin}[T], 0, 0, 0\}, \left\{\mathrm{Sin}[T], \mathrm{Cos}[T], \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T], 0, 0\right\}, \left\{0, \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T], 0, \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T], 0\right\}, \left\{0, 0, \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T], -\mathrm{Cos}[T], \mathrm{Sin}[T]\right\}, \{0, 0, 0, \mathrm{Sin}[T], -2\,\mathrm{Cos}[T]\}\right\}$

Out[391]//MatrixForm=

$$\begin{pmatrix} 2\,\mathrm{Cos}[T] & \mathrm{Sin}[T] & 0 & 0 & 0 \\ \mathrm{Sin}[T] & \mathrm{Cos}[T] & \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T] & 0 & 0 \\ 0 & \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T] & 0 & \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T] & 0 \\ 0 & 0 & \sqrt{\frac{3}{2}}\,\mathrm{Sin}[T] & -\mathrm{Cos}[T] & \mathrm{Sin}[T] \\ 0 & 0 & 0 & \mathrm{Sin}[T] & -2\,\mathrm{Cos}[T] \end{pmatrix}$$

Out[393]= Sprawdzanie czy wektor jest wektorem własnym danej macierzy

Out[394]= True

Out[395]= True

Out[396]= True

Out[397]= True

Out[398]= True

Out[399]//MatrixForm=

$$\begin{pmatrix} -2 \\ 2 \\ -1 \\ 1 \\ 0 \end{pmatrix}$$

Out[400]//MatrixForm=

$$\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

Out[401]//MatrixForm=

$$\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

Out[402]//MatrixForm=

$$\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

Out[403]//MatrixForm=

$$\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

Out[404]//MatrixForm=

$$\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

Out[405]= Czyli warotści włąsne to kolejno[2,1,0,-1,-2]

Out[406]= ...

Out[407]= Pchnięcia Y

Out[408]=

$$\Big\{\Big\{\mathrm{Cosh}\Big[\frac{w}{2}\Big]^4,\ -\frac{1}{2}\, i\, \big(1+\mathrm{Cosh}[w]\big)\,\mathrm{Sinh}[w],\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[w]^2,\ i\,\mathrm{Sinh}\Big[\frac{w}{2}\Big]^2\mathrm{Sinh}[w],\ \mathrm{Sinh}\Big[\frac{w}{2}\Big]^4\Big\},$$

$$\Big\{\frac{1}{2}\, i\, \big(1+\mathrm{Cosh}[w]\big)\,\mathrm{Sinh}[w],\ \frac{1}{2}\big(\mathrm{Cosh}[w]+\mathrm{Cosh}[2w]\big),$$

$$-i\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w],\ \frac{1}{2}\big(\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\big),\ i\,\mathrm{Sinh}\Big[\frac{w}{2}\Big]^2\mathrm{Sinh}[w]\Big\},$$

$$\Big\{-\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[w]^2,\ i\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w],\ \frac{1}{4}\big(1+3\,\mathrm{Cosh}[2w]\big),\ -i\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w],$$

$$-\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[w]^2\Big\},\ \Big\{-i\,\mathrm{Sinh}\Big[\frac{w}{2}\Big]^2\mathrm{Sinh}[w],\ \frac{1}{2}\big(\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\big),$$

$$i\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w],\ \frac{1}{2}\big(\mathrm{Cosh}[w]+\mathrm{Cosh}[2w]\big),\ -\frac{1}{2}\, i\,\big(1+\mathrm{Cosh}[w]\big)\,\mathrm{Sinh}[w]\Big\},$$

$$\Big\{\mathrm{Sinh}\Big[\frac{w}{2}\Big]^4,\ -i\,\mathrm{Sinh}\Big[\frac{w}{2}\Big]^2\mathrm{Sinh}[w],\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[w]^2,\ \frac{1}{2}\, i\,\big(1+\mathrm{Cosh}[w]\big)\,\mathrm{Sinh}[w],\ \mathrm{Cosh}\Big[\frac{w}{2}\Big]^4\Big\}\Big\}$$

Out[409]//MatrixForm=

$$\begin{pmatrix} \text{Cosh}\left[\frac{w}{2}\right]^4 & -\frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w])\,\text{Sinh}[w] & -\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2 & \mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\,\text{Si} \\ \frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w])\,\text{Sinh}[w] & \frac{1}{2}(\text{Cosh}[w]+\text{Cosh}[2w]) & -\mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w] & \frac{1}{2}(\text{Cosh}[w]-\text{Cos} \\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2 & \mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w] & \frac{1}{4}(1+3\,\text{Cosh}[2w]) & -\mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w] \\ -\mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\,\text{Sinh}[w] & \frac{1}{2}(\text{Cosh}[w]-\text{Cosh}[2w]) & \mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w] & \frac{1}{2}(\text{Cosh}[w]+\text{Cos} \\ \text{Sinh}\left[\frac{w}{2}\right]^4 & -\mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\,\text{Sinh}[w] & -\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2 & \frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w]) \end{pmatrix}$$

Out[410]= Kolumny macierzy obrotu o Y

Out[411]= $\left\{\text{Cosh}\left[\frac{w}{2}\right]^4,\ \frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w])\,\text{Sinh}[w],\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2,\ -\mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\text{Sinh}[w],\ \text{Sinh}\left[\frac{w}{2}\right]^4\right\}$

Out[412]= $\left\{-\frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w])\,\text{Sinh}[w],\ \frac{1}{2}(\text{Cosh}[w]+\text{Cosh}[2w]),\ \mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w],\ \frac{1}{2}(\text{Cosh}[w]-\text{Cosh}[2w]),\ -\mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\text{Sinh}[w]\right\}$

Out[413]= $\left\{-\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2,\ -\mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w],\ \frac{1}{4}(1+3\,\text{Cosh}[2w]),\ \mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w],\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2\right\}$

Out[414]= $\left\{\mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\text{Sinh}[w],\ \frac{1}{2}(\text{Cosh}[w]-\text{Cosh}[2w]),\ -\mathrm{i}\sqrt{\frac{3}{2}}\,\text{Cosh}[w]\,\text{Sinh}[w],\ \frac{1}{2}(\text{Cosh}[w]+\text{Cosh}[2w]),\ \frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w])\,\text{Sinh}[w]\right\}$

Out[415]= $\left\{\text{Sinh}\left[\frac{w}{2}\right]^4,\ \mathrm{i}\,\text{Sinh}\left[\frac{w}{2}\right]^2\text{Sinh}[w],\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\text{Sinh}[w]^2,\ -\frac{1}{2}\,\mathrm{i}\,(1+\text{Cosh}[w])\,\text{Sinh}[w],\ \text{Cosh}\left[\frac{w}{2}\right]^4\right\}$

Out[416]= Ortogonalność

Out[417]= 0

Out[418]= 0

Out[419]= 0

Out[420]= 1

Out[421]= 0

Out[422]= -1

Out[423]= 0

Out[424]= 0

Out[425]= 0

Out[426]= 0

Out[427]= Normalizacja

Out[428]= 1

Out[429]= 1

Out[430]= 1

Out[431]= 1

Out[432]= 1

Out[433]= Macierz strorzona z iloczynu wektorów

Out[434]= {{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}}

Out[439]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Out[440]= Pchniecie znalezionej macierzy Y i X

Out[441]//MatrixForm=

$$\begin{pmatrix} \mathrm{Sinh}\left[\frac{w}{2}\right]^4 & -\mathrm{i}\,\mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w] & 0 & \frac{1}{2}\mathrm{i}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & \mathrm{Cos}\ldots \\ \mathrm{i}\,\mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w] & \frac{1}{2}\left(-\mathrm{Cosh}[w]+\mathrm{Cosh}[2w]\right) & 0 & \frac{1}{2}\left(-\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\right) & \frac{1}{2}\mathrm{i}\left(1+\mathrm{Cos}\ldots\right. \\ -\frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[w]^2 & \mathrm{i}\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w] & 0 & -\mathrm{i}\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w] & -\frac{1}{2}\sqrt{\frac{3}{2}}\ldots \\ -\frac{1}{2}\mathrm{i}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & \frac{1}{2}\left(-\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\right) & 0 & \frac{1}{2}\left(-\mathrm{Cosh}[w]+\mathrm{Cosh}[2w]\right) & -\mathrm{i}\,\mathrm{Sinh}\left[\ldots\right. \\ \mathrm{Cosh}\left[\frac{w}{2}\right]^4 & -\frac{1}{2}\mathrm{i}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & 0 & \mathrm{i}\,\mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w] & \mathrm{Sin}\ldots \end{pmatrix}$$

Out[442]//MatrixForm=

$$\begin{pmatrix} \mathrm{Sinh}\left[\frac{w}{2}\right]^4 & -\mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w] & 0 & -\frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & \mathrm{Cosh}\left[\frac{w}{2}\right]^4 \\ \mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w] & \frac{1}{2}\left(\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\right) & 0 & \frac{1}{2}\left(-\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\right) & \frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{S}\ldots \\ \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[w]^2 & -\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w] & 0 & -\sqrt{\frac{3}{2}}\,\mathrm{Cosh}[w]\,\mathrm{Sinh}[w] & \frac{1}{2}\sqrt{\frac{3}{2}}\,\mathrm{Sinh}[\ldots \\ \frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & \frac{1}{2}\left(-\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\right) & 0 & \frac{1}{2}\left(\mathrm{Cosh}[w]-\mathrm{Cosh}[2w]\right) & \mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}\ldots \\ \mathrm{Cosh}\left[\frac{w}{2}\right]^4 & -\frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & 0 & -\mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w] & \mathrm{Sinh}\left[\frac{w}{2}\right]^4 \end{pmatrix}$$

Out[443]= Pchniecie wektórw własnych znalezionej macierzy Y i X

Out[444]//MatrixForm=

$$\begin{pmatrix}
-\mathrm{Cosh}\left[\frac{w}{2}\right]^4-\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2 & -\frac{1}{2}\,i\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w]-i\,\mathrm{Sinh}\left[\frac{w}{2}\right]^2\mathrm{Sin} \\
-i\sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\,\mathrm{Sinh}[w]-\frac{1}{2}\,i\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & \frac{1}{2}\left(-\mathrm{Cosh}[w]+\mathrm{Cosh}[2\,w]\right)+\frac{1}{2}\left(\mathrm{Cosh}[w]+\mathrm{Cosh}\right. \\
\frac{1}{4}\left(1+3\,\mathrm{Cosh}[2\,w]\right)+\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2 & i\sqrt{6}\ \mathrm{Cosh}[w]\,\mathrm{Sinh}[w] \\
i\sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\,\mathrm{Sinh}[w]+i\,\mathrm{Sinh}\left[\frac{w}{2}\right]^2\mathrm{Sinh}[w] & \frac{1}{2}\left(-\mathrm{Cosh}[w]-\mathrm{Cosh}[2\,w]\right)+\frac{1}{2}\left(\mathrm{Cosh}[w]-\mathrm{Cosh}\right. \\
-\mathrm{Sinh}\left[\frac{w}{2}\right]^4-\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2 & -\frac{1}{2}\,i\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w]-i\,\mathrm{Sinh}\left[\frac{w}{2}\right]^2\mathrm{Sin}
\end{pmatrix}$$

Out[445]//MatrixForm=

$$\begin{pmatrix}
-\mathrm{Cosh}\left[\frac{w}{2}\right]^4+\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2 & \frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w]-\mathrm{Sinh}\left[\frac{w}{2}\right]^2\mathrm{Sinh}[w] \\
\sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\,\mathrm{Sinh}[w]-\frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w] & \frac{1}{2}\left(\mathrm{Cosh}[w]-\mathrm{Cosh}[2\,w]\right)+\frac{1}{2}\left(\mathrm{Cosh}[w]+\mathrm{Cosh}[2\,w]\right. \\
\frac{1}{4}\left(1+3\,\mathrm{Cosh}[2\,w]\right)-\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2 & 0 \\
\sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\,\mathrm{Sinh}[w]-\mathrm{Sinh}\left[\frac{w}{2}\right]^2\mathrm{Sinh}[w] & \frac{1}{2}\left(-\mathrm{Cosh}[w]-\mathrm{Cosh}[2\,w]\right)+\frac{1}{2}\left(-\mathrm{Cosh}[w]+\mathrm{Cosh}[2\,\right. \\
-\mathrm{Sinh}\left[\frac{w}{2}\right]^4+\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2 & -\frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w]+\mathrm{Sinh}\left[\frac{w}{2}\right]^2\mathrm{Sinh}[w]
\end{pmatrix}$$

Out[446]= Pchnięcia X

Out[447]= $\left\{\left\{\cosh\left[\frac{w}{2}\right]^4, \frac{1}{2}\left(1+\cosh[w]\right)\sinh[w], \frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2, \sinh\left[\frac{w}{2}\right]^2\sinh[w], \sinh\left[\frac{w}{2}\right]^4\right\},\right.$

$\left\{\frac{1}{2}\left(1+\cosh[w]\right)\sinh[w], \frac{1}{2}\left(\cosh[w]+\cosh[2w]\right),\right.$

$\left.\sqrt{\frac{3}{2}}\cosh[w]\sinh[w], \frac{1}{2}\left(-\cosh[w]+\cosh[2w]\right), \sinh\left[\frac{w}{2}\right]^2\sinh[w]\right\},$

$\left\{\frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2, \sqrt{\frac{3}{2}}\cosh[w]\sinh[w], \frac{1}{4}\left(1+3\cosh[2w]\right), \sqrt{\frac{3}{2}}\cosh[w]\sinh[w],\right.$

$\left.\frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2\right\}, \left\{\sinh\left[\frac{w}{2}\right]^2\sinh[w], \frac{1}{2}\left(-\cosh[w]+\cosh[2w]\right),\right.$

$\left.\sqrt{\frac{3}{2}}\cosh[w]\sinh[w], \frac{1}{2}\left(\cosh[w]+\cosh[2w]\right), \frac{1}{2}\left(1+\cosh[w]\right)\sinh[w]\right\},$

$\left.\left\{\sinh\left[\frac{w}{2}\right]^4, \sinh\left[\frac{w}{2}\right]^2\sinh[w], \frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2, \frac{1}{2}\left(1+\cosh[w]\right)\sinh[w], \cosh\left[\frac{w}{2}\right]^4\right\}\right\}$

Out[448]//MatrixForm=

$$\left(\begin{array}{cccc}
\cosh\left[\frac{w}{2}\right]^4 & \frac{1}{2}\left(1+\cosh[w]\right)\sinh[w] & \frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2 & \sinh\left[\frac{w}{2}\right]^2\sinh[w] \\
\frac{1}{2}\left(1+\cosh[w]\right)\sinh[w] & \frac{1}{2}\left(\cosh[w]+\cosh[2w]\right) & \sqrt{\frac{3}{2}}\cosh[w]\sinh[w] & \frac{1}{2}\left(-\cosh[w]+\cosh[2w]\right. \\
\frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2 & \sqrt{\frac{3}{2}}\cosh[w]\sinh[w] & \frac{1}{4}\left(1+3\cosh[2w]\right) & \sqrt{\frac{3}{2}}\cosh[w]\sinh[w] \\
\sinh\left[\frac{w}{2}\right]^2\sinh[w] & \frac{1}{2}\left(-\cosh[w]+\cosh[2w]\right) & \sqrt{\frac{3}{2}}\cosh[w]\sinh[w] & \frac{1}{2}\left(\cosh[w]+\cosh[2w]\right. \\
\sinh\left[\frac{w}{2}\right]^4 & \sinh\left[\frac{w}{2}\right]^2\sinh[w] & \frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2 & \frac{1}{2}\left(1+\cosh[w]\right)\sinh[w
\end{array}\right.$$

Out[449]= Kolumny macierzy obrotu o X

Out[450]= $\left\{\cosh\left[\frac{w}{2}\right]^4, \frac{1}{2}\left(1+\cosh[w]\right)\sinh[w], \frac{1}{2}\sqrt{\frac{3}{2}}\sinh[w]^2, \sinh\left[\frac{w}{2}\right]^2\sinh[w], \sinh\left[\frac{w}{2}\right]^4\right\}$

Out[451]= $\left\{\frac{1}{2}\left(1+\cosh[w]\right)\sinh[w], \frac{1}{2}\left(\cosh[w]+\cosh[2w]\right),\right.$

$\left.\sqrt{\frac{3}{2}}\cosh[w]\sinh[w], \frac{1}{2}\left(-\cosh[w]+\cosh[2w]\right), \sinh\left[\frac{w}{2}\right]^2\sinh[w]\right\}$

Out[452]= $\left\{\frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2,\ \sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\ \mathrm{Sinh}[w],\ \frac{1}{4}\left(1+3\,\mathrm{Cosh}[2\,w]\right),\ \sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\ \mathrm{Sinh}[w],\ \frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2\right\}$

Out[453]= $\left\{\mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w],\ \frac{1}{2}\left(-\mathrm{Cosh}[w]+\mathrm{Cosh}[2\,w]\right),\ \sqrt{\frac{3}{2}}\ \mathrm{Cosh}[w]\ \mathrm{Sinh}[w],\ \frac{1}{2}\left(\mathrm{Cosh}[w]+\mathrm{Cosh}[2\,w]\right),\ \frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w]\right\}$

Out[454]= $\left\{\mathrm{Sinh}\left[\frac{w}{2}\right]^4,\ \mathrm{Sinh}\left[\frac{w}{2}\right]^2 \mathrm{Sinh}[w],\ \frac{1}{2}\sqrt{\frac{3}{2}}\ \mathrm{Sinh}[w]^2,\ \frac{1}{2}\left(1+\mathrm{Cosh}[w]\right)\mathrm{Sinh}[w],\ \mathrm{Cosh}\left[\frac{w}{2}\right]^4\right\}$

Out[455]= Ortogonalność

Out[456]= 0

Out[457]= 0

Out[458]= 0

Out[459]= 1

Out[460]= 0

Out[461]= -1

Out[462]= 0

Out[463]= 0

Out[464]= 0

Out[465]= 0

Out[466]= Sprawdzenie czy dla pchnięcia w X była by taka sama macierz, jak widać TAK