

```
In[1]:= SetDirectory["~/writing/WIP/KappaLib/"];
<< kappaLib.m
KappaLib v1.1
```

```
In[3]:= vars = {xi0, xi1, xi2, xi3};
```

### ■ Example 5.4

#### ■ Medium 1

```
In[4]:= A1 =  $\begin{pmatrix} 0 & -1 & 1 \\ -1 & -2 & 1 \\ 1 & 1 & -1 \end{pmatrix};$ 
```

```
B1 =  $\begin{pmatrix} 0 & \frac{1}{2} & 0 \\ \frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix};$ 
```

```
C1 =  $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 2 & 1 \\ \frac{1}{2} & -\frac{1}{2} & 1 \end{pmatrix};$ 
```

```
D1 = Transpose[C1];
kappa1 = emABCDToKappa[A1, B1, C1, D1];
Simplify[emKappaToFresnel[kappa1, vars]]
```

```
Out[9]= (xi0 - xi1) (xi0 - xi2)3
```

#### ■ Medium 2

```
In[10]:= L = {{1, 0, 0, 0}, {0, 0, 1, 0}, {0, 1, 0, 0}, {0, 0, 0, 1}};
L // MatrixForm
kappa2 = emCoordinateChange[kappa1, L];
Simplify[emKappaToFresnel[kappa2, vars]]
```

```
Out[11]//MatrixForm=
```

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

```
Out[13]= -(xi0 - xi1)3 (xi0 - xi2)
```

- The two media have the same Fresnel surfaces, but their Tamm-Rubilar tensor densities do not coincide
- ABCD representation for medium 2

```
In[14]:= {A2, B2, C2, D2} = emKappaToABCD[kappa2];
A2 // MatrixForm
B2 // MatrixForm
C2 // MatrixForm
C2 - Transpose[D2] // MatrixForm
```

Out[15]//MatrixForm=

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

Out[16]//MatrixForm=

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

Out[17]//MatrixForm=

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

Out[18]//MatrixForm=

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

### ■ Determinants

```
In[19]:= emDet[kappa1]
emDet[kappa2]
emTrace[kappa1]
emTrace[kappa2]
```

Out[19]= 1

Out[20]= 1

Out[21]= 6

Out[22]= 6

### ■ Compute trace-free parts

```
In[23]:= kappa1T0 = kappa1 - emIdentityKappa[];
kappa2T0 = kappa2 - emIdentityKappa[];
```

```
In[25]:= emTrace[kappa1T0]
emTrace[kappa2T0]
```

Out[25]= 0

Out[26]= 0

```
In[27]:= emDet[kappa1T0]
emDet[kappa2T0]
```

Out[27]= 0

Out[28]= 0

### ■ Extra:

```
In[29]:= Eigenvalues[emKappaToMatrix[kappa1]]
Eigenvalues[emKappaToMatrix[kappa2]]
```

Out[29]= {1, 1, 1, 1, 1, 1}

Out[30]= {1, 1, 1, 1, 1, 1}

```
In[31]:= Eigenvalues[emKappaToMatrix[emHodge[DiagonalMatrix[{-1, 1, 1, 1}]]]]
```

```
Out[31]= {i, i, i, -i, -i, -i}
```