

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

- **Note:** in the below we use `emCoordinateChnage[kappa, L]` that computes the coordinate change for an untwisted tensor. However, since all coordinate changes are orientation preserving, we can also use the same routine to compute coordinate changes for twisted tensors.

For further description of `emCoordinateChange[kappa,L]`, see `kappaLib.m`

Metaclass II

```
In[3]:= mat = 
$$\begin{pmatrix} a1 & -b1 & 0 & 0 & 0 & 0 \\ b1 & a1 & 0 & 0 & 0 & 0 \\ 0 & 0 & a2 & 0 & 0 & -b2 \\ 0 & 1 & 0 & a1 & b1 & 0 \\ 1 & 0 & 0 & -b1 & a1 & 0 \\ 0 & 0 & b2 & 0 & 0 & a2 \end{pmatrix};$$

```

```
kappa = emMatrixToKappa[mat];
```

```
In[5]:= (* Define coordinate change and check that it is orientation preserving *)
```

```
jacobian = 
$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$

```

```
Det[jacobian]
```

```
Out[6]= 1
```

```
In[7]:= kappaT = emCoordinateChange[kappa, jacobian];
emKappaToMatrix[kappaT] // MatrixForm
```

```
Out[8]//MatrixForm=
```

```

$$\begin{pmatrix} a1 & -b1 & 0 & 0 & 0 & 0 \\ b1 & a1 & 0 & 0 & 0 & 0 \\ 0 & 0 & a2 & 0 & 0 & -b2 \\ 0 & -1 & 0 & a1 & b1 & 0 \\ -1 & 0 & 0 & -b1 & a1 & 0 \\ 0 & 0 & b2 & 0 & 0 & a2 \end{pmatrix}$$

```

- All entries remain the same except the two “1”-entries that are transformed into “-1”-entries.

Metaclass III

```
In[9]:= mat = 
$$\begin{pmatrix} a1 & -b1 & 0 & 0 & 0 & 0 \\ b1 & a1 & 0 & 0 & 0 & 0 \\ 1 & 0 & a1 & 0 & 0 & -b1 \\ 0 & 0 & 0 & a1 & b1 & 1 \\ 0 & 0 & 1 & -b1 & a1 & 0 \\ 0 & 1 & b1 & 0 & 0 & a1 \end{pmatrix};$$

```

```
kappa = emMatrixToKappa[mat];
```

```
In[11]:= (* Define coordinate change and check that it is orientation preserving *)
```

$$\text{jacobian} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$

```
Det[jacobian]
```

```
Out[12]= 1
```

```
In[13]:= kappaT = emCoordinateChange[kappa, jacobian];
emKappaToMatrix[kappaT] // MatrixForm
```

```
Out[14]//MatrixForm=
```

$$\begin{pmatrix} a1 & -b1 & 0 & 0 & 0 & 0 \\ b1 & a1 & 0 & 0 & 0 & 0 \\ -1 & 0 & a1 & 0 & 0 & -b1 \\ 0 & 0 & 0 & a1 & b1 & -1 \\ 0 & 0 & -1 & -b1 & a1 & 0 \\ 0 & -1 & b1 & 0 & 0 & a1 \end{pmatrix}$$

- All entries remain the same except the two “1”-entries that are transformed into “-1”-entries.

Metaclass V

```
In[15]:= mat =
```

$$\begin{pmatrix} a1 & -b1 & 0 & 0 & 0 & 0 \\ b1 & a1 & 0 & 0 & 0 & 0 \\ 0 & 0 & a2 & 0 & 0 & a3 \\ 0 & 1 & 0 & a1 & b1 & 0 \\ 1 & 0 & 0 & -b1 & a1 & 0 \\ 0 & 0 & a3 & 0 & 0 & a2 \end{pmatrix};$$

```
kappa = emMatrixToKappa[mat];
```

```
In[17]:= (* Define coordinate change and check that it is orientation preserving *)
```

$$\text{jacobian} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix};$$

```
Det[jacobian]
```

```
Out[18]= 1
```

```
In[19]:= kappaT = emCoordinateChange[kappa, jacobian];
emKappaToMatrix[kappaT] // MatrixForm
```

```
Out[20]//MatrixForm=
```

$$\begin{pmatrix} a1 & -b1 & 0 & 0 & 0 & 0 \\ b1 & a1 & 0 & 0 & 0 & 0 \\ 0 & 0 & a2 & 0 & 0 & a3 \\ 0 & -1 & 0 & a1 & b1 & 0 \\ -1 & 0 & 0 & -b1 & a1 & 0 \\ 0 & 0 & a3 & 0 & 0 & a2 \end{pmatrix}$$

- All entries remain the same except the two “1”-entries that are transformed into “-1”-entries.