Euler Winkel

Individuelle Rotationen Z, X', Z''

In[324]:=
```
(rotZϕ = {{Cos[ϕ], Sin[ϕ], 0}, {-Sin[ϕ], Cos[ϕ], 0}, {0, 0, 1}}) // MatrixForm
```

Out[324]//MatrixForm=

$$\begin{pmatrix} \mathrm{Cos}[\phi] & \mathrm{Sin}[\phi] & 0 \\ -\mathrm{Sin}[\phi] & \mathrm{Cos}[\phi] & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

In[325]:=
```
(rotXθ = {{1, 0, 0}, {0, Cos[θ], Sin[θ]}, {0, -Sin[θ], Cos[θ]}}) // MatrixForm
```

Out[325]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & \mathrm{Cos}[\theta] & \mathrm{Sin}[\theta] \\ 0 & -\mathrm{Sin}[\theta] & \mathrm{Cos}[\theta] \end{pmatrix}$$

In[326]:=
```
(rotZψ = rotZϕ /. ϕ → ψ) // MatrixForm
```

Out[326]//MatrixForm=

$$\begin{pmatrix} \mathrm{Cos}[\psi] & \mathrm{Sin}[\psi] & 0 \\ -\mathrm{Sin}[\psi] & \mathrm{Cos}[\psi] & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Produkt der Rotationen

In[343]:=
```
(Euler = rotZψ.rotXθ.rotZϕ);
```

In[344]:=
```
(Euler /. Cos[ϕ_] → C[ϕ] /. Sin[ϕ_] → S[ϕ]) // MatrixForm
```

Out[344]//MatrixForm=

$$\begin{pmatrix} \mathrm{C}[\phi]\,\mathrm{C}[\psi] - \mathrm{C}[\theta]\,\mathrm{S}[\phi]\,\mathrm{S}[\psi] & \mathrm{C}[\psi]\,\mathrm{S}[\phi] + \mathrm{C}[\theta]\,\mathrm{C}[\phi]\,\mathrm{S}[\psi] & \mathrm{S}[\theta]\,\mathrm{S}[\psi] \\ -\mathrm{C}[\theta]\,\mathrm{C}[\psi]\,\mathrm{S}[\phi] - \mathrm{C}[\phi]\,\mathrm{S}[\psi] & \mathrm{C}[\theta]\,\mathrm{C}[\phi]\,\mathrm{C}[\psi] - \mathrm{S}[\phi]\,\mathrm{S}[\psi] & \mathrm{C}[\psi]\,\mathrm{S}[\theta] \\ \mathrm{S}[\theta]\,\mathrm{S}[\phi] & -\mathrm{C}[\phi]\,\mathrm{S}[\theta] & \mathrm{C}[\theta] \end{pmatrix}$$

Plot

In[330]:=
```
origin = {0, 0, 0};
```

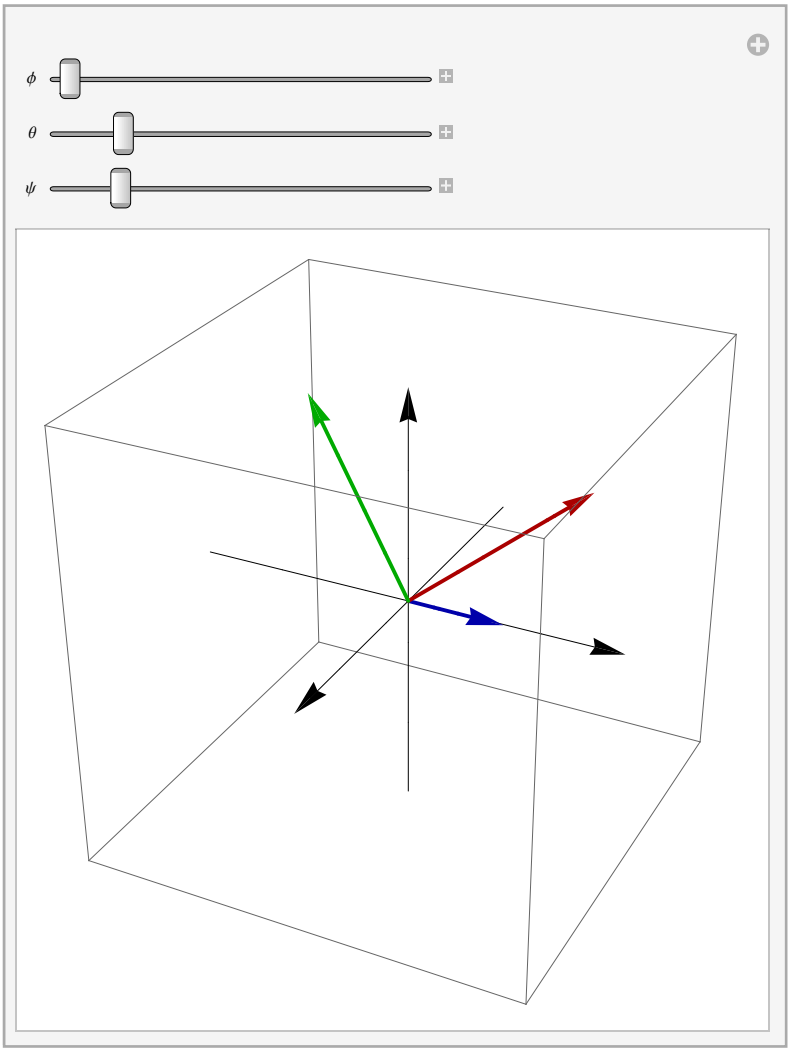
In[331]:=
```
axes = {Thick, Darker[Blue], Arrow[{origin, Euler[[1]]}],
      Darker[Red], Arrow[{origin, Euler[[2]]}], Darker[Green],
      Arrow[{origin, Euler[[3]]}]} /. ϕ → α /. θ → β /. ψ → γ;
```

In[332]:=
```
lines = {Black, Arrow[{{-1, 0, 0}, {1, 0, 0}}],
   Arrow[{{0, -1, 0}, {0, 1, 0}}], Arrow[{{0, 0, -1}, {0, 0, 1}}]};
```

In[333]:=
```
AxesRot[ϕ_, θ_, ψ_] :=
  Graphics3D[{lines, axes} /. α → ϕ /. β → θ /. γ → ψ, ViewPoint → {Pi, Pi / 2, 2}];
```

In[334]:=
```
Manipulate[AxesRot[ϕ, θ, ψ], {ϕ, 0, 2 π}, {θ, 0, π}, {ψ, 0, 2 π}]
```

Out[334]=



Winkelgeschwindigkeit

Übung 9, Aufgabe 2