Computergrafik 1

Lösung Blatt 3

Aufgabe 1

1. Rotation von -33,7° um die Y-Achse (Matrix Ry)
2. Rotation von -56,3° um die X-Achse (Matrix Rx)
3. Translation von 2,36 in der Z-Achse (Matrix Tz)

Transformationsmatrix:

A = Tz * Rx * Ry

Aufgabe 1

$$Tz = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2.36 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Rx = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(-56.3) & -\sin(-56.3) & 0 \\ 0 & \sin(-56.3) & \cos(-56.3) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0.55 & 0.83 & 0 \\ 0 & -0.83 & 0.55 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$Ry = \begin{pmatrix} \cos(-33.7) & 0 & sin(-33.7) & 0 \\ 0 & 1 & 0 & 0 \\ -\sin(-33.7) & 0 & \cos(-33.7) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0.83 & 0 & -0.55 & 0 \\ 0 & 1 & 0 & 0 \\ 0.55 & 0 & 0.83 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Aufgabe 1

$$A = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2.36 \\ 0 & 0 & 0 & 1 \end{pmatrix} * \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0.55 & 0.83 & 0 \\ 0 & -0.83 & 0.55 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} * \begin{pmatrix} 0.83 & 0 & -0.55 & 0 \\ 0 & 1 & 0 & 0 \\ 0.55 & 0 & 0.83 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

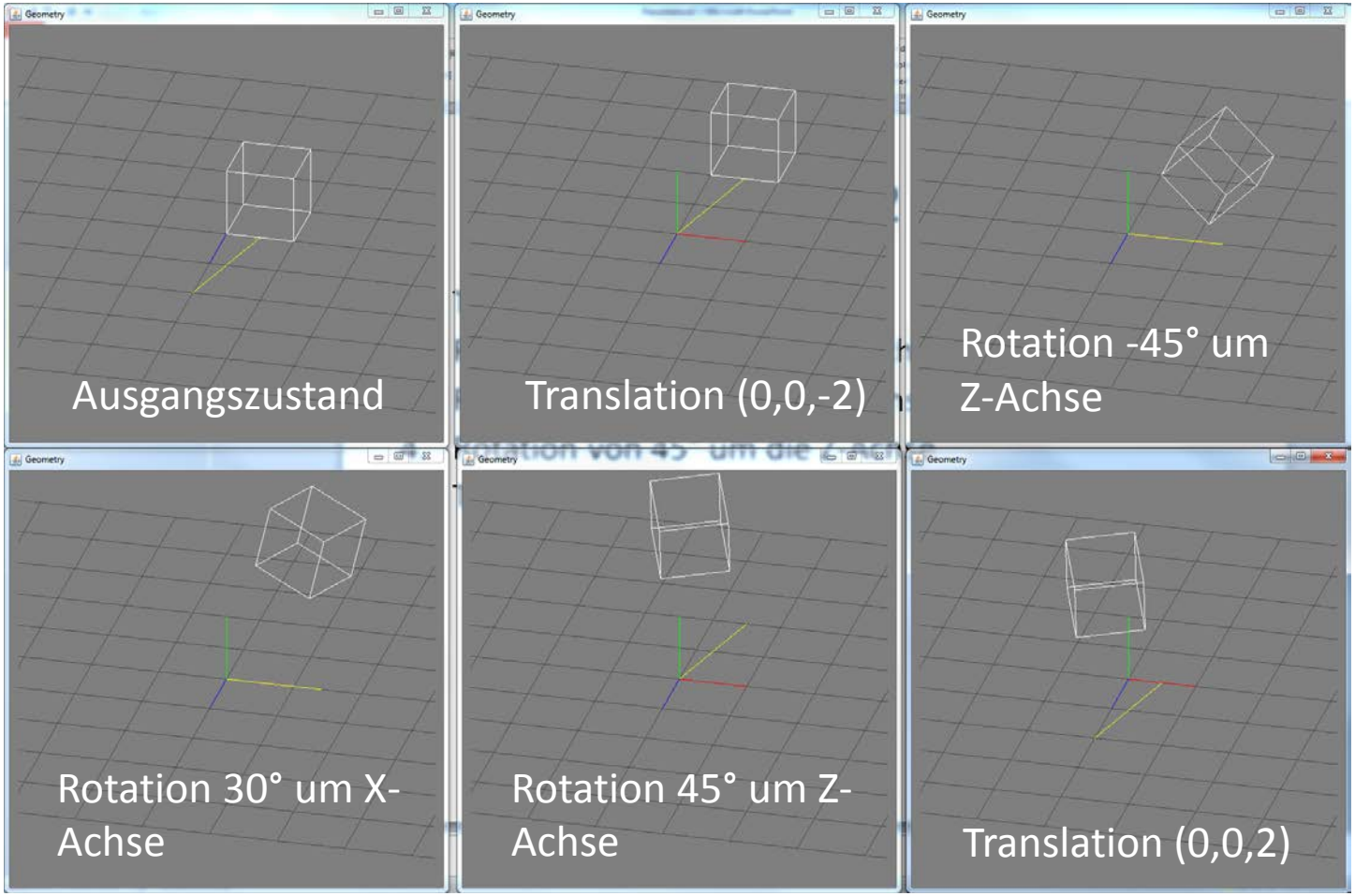
$$A = \begin{pmatrix} 0.83 & 0 & -0.55 & 0 \\ 0.46 & 0.55 & 0.69 & 0 \\ 0.30 & -0.83 & 0.46 & 2.36 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Spur von A: 0.83 + 0.55 + 0.46 + 1 = 2.84

Aufgabe 2

1. Translation um (0,0,-2)
2. Rotation von -45° um die Z-Achse
3. Rotation von 30° um die X-Achse
4. Rotation von 45° um die Z-Achse
5. Translation um (0,0,2)

Aufgabe 2


Ausgangszustand
Translation (0,0,-2)
Rotation -45° um Z-Achse
Rotation 30° um X-Achse
Rotation 45° um Z-Achse
Translation (0,0,2)

Aufgabe 2

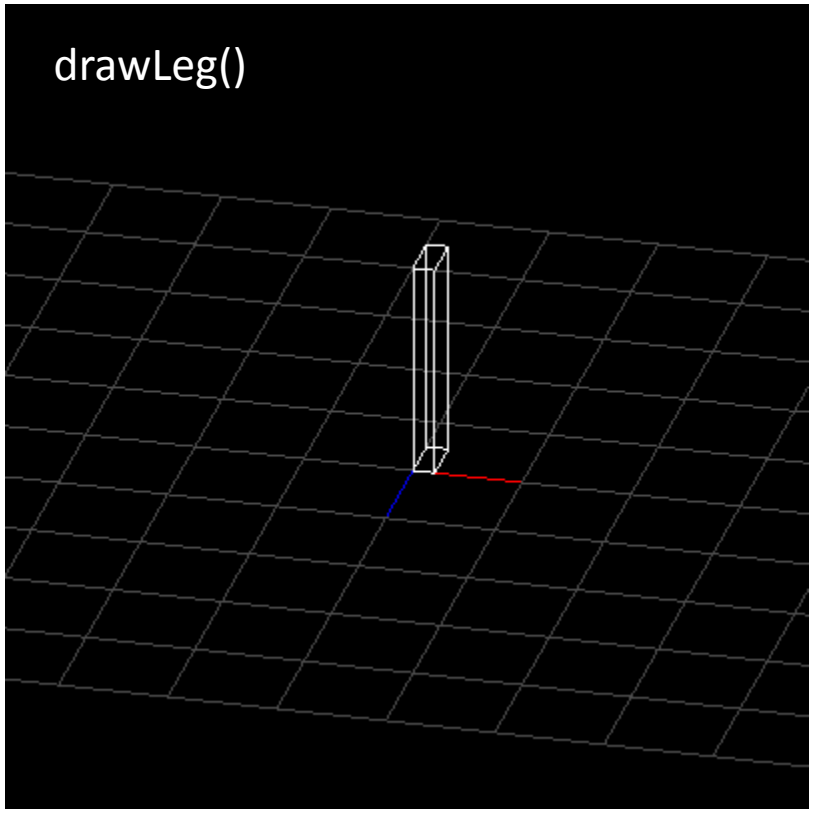
```
gl.glTranslated(0, 0, 2); // Last step first!
gl.glRotated(45,0,0,1);
gl.glRotated(30,1,0,0); // Desired rotation
gl.glRotated(-45,0,0,1);
gl.glTranslated(0, 0, -2); // First step last!

gl.glColor3d(1, 1, 1);
drawBox(gl,1,1,1);
```

Aufgabe 3 (1)

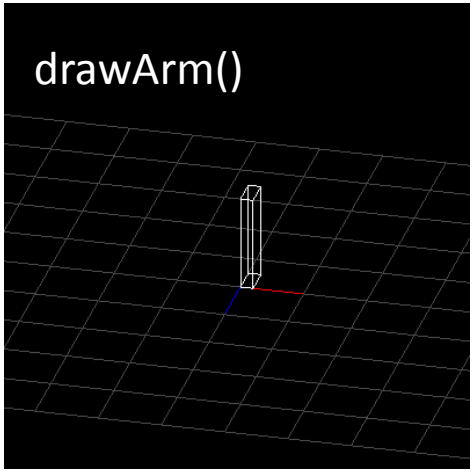
Pseudocode für *drawRobot*:

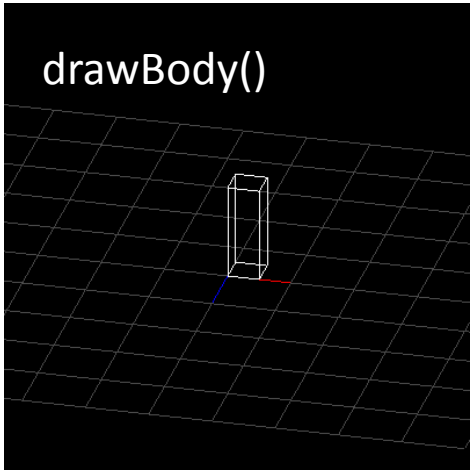
```
pushMatrix
        translateLeg
        drawLeg
popMatrix
pushMatrix
        translateLeg
        drawLeg
popMatrix
```



Aufgabe 3 (2)

```
pushMatrix
        translateBody
        pushMatrix
                translateArm
                rotateArm
                drawArm
        popMatrix
        pushMatrix
                translateArm
                rotateArm
                drawArm
        popMatrix
        drawBody
popMatrix
```





Aufgabe 3 (3)

pushMatrix

translateHead

drawHead

popMatrix