

Miniproject 4

Applications to Computer Graphics

In this miniproject you will learn about rotations of 3D-space and see how matrices are applied in computer graphics. Start by reading Section 6.9, from page 587 to the middle of page 589. (An orthogonal matrix is a square matrix whose columns are orthogonal unit vectors). Then solve the following problems by hand:

- Section 6.9, page 599, Problems no. 1, 3, 5.

Download the files *tower.m* and *linesegmentplot.m* from the webpage www.first.math.aau.dk and save them in your MATLAB folder. Read the text in the script *tower.m*. Run the script in MATLAB such that both the command window and the figure window are visible.

- Modify the script, such that the original tower is rotated 30° about the y-axis.
- Apply the transformation matrices from problems 1, 3 and 5 above to the original tower and plot the result in each case.

Another type of matrix, which is used in computer graphics, is the scaling matrix.

$$S = \begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & s_z \end{bmatrix}$$

- Compute the matrix-vector product $S\mathbf{v}$, where $\mathbf{v} = [x \ y \ z]^T$. Which effect does left multiplication by S have on 3D-vectors?
- Modify the script such that the original tower is scaled by 2 in the z -direction, and plot the result.