

Graphics 2 exercise classes

Exercise 7

Change of a coordinate system – preparation for virtual camera viewing and projections

1. (Pen and paper exercise)

A triangle with homogeneous vertices

$$A = [3 \ 2 \ 1]^T$$

$$B = [9 \ 2 \ 1]^T$$

$$C = [7 \ 10 \ 1]^T$$

is defined in a 2D coordinate system $W1$.

Using matrix operations, compute the coordinates of the triangle in another 2D coordinate system, $W2$, the centre of which is placed at point $D = (6, 5)$ in the coordinate system $W1$.

2. (Pen and paper exercise)

A triangle with homogeneous vertices

$$A = [3 \ 2 \ 1]^T$$

$$B = [9 \ 2 \ 1]^T$$

$$C = [7 \ 10 \ 1]^T$$

is defined in a 2D coordinate system $W1$.

Using matrix operations, compute the coordinates of the triangle in another 2D coordinate system, $W2$, the centre of which is placed at point $D = (6, 5)$ in the coordinate system $W1$ and the Y axis of which points towards the centre of $W1$.

3. Write Matlab implementation of exercises 1 and 2. Matlab file `ex7_triangles.m` includes code for the definition and display of the triangle. Matlab functions related to transformation matrix definitions, some vector operations etc are listed below

Relevant Matlab functions

- dot product of two vectors: `dot(A, B)`
- cross product of two vectors: `cross(A, B)`
- vector length: `vlength(A, B)`
- define a transformation matrix for translation by vector A : `makehgtform('translate', A)`
- define a transformation matrix for rotation by t radians:
 - about X axis: `makehgtform('xrotate', t)`
 - about Y axis: `makehgtform('yrotate', t)`
 - about Z axis: `makehgtform('zrotate', t)`
- define an identity matrix of size $n \times n$: `eye(n)`