

2nd Task

Cube construction AND rotation

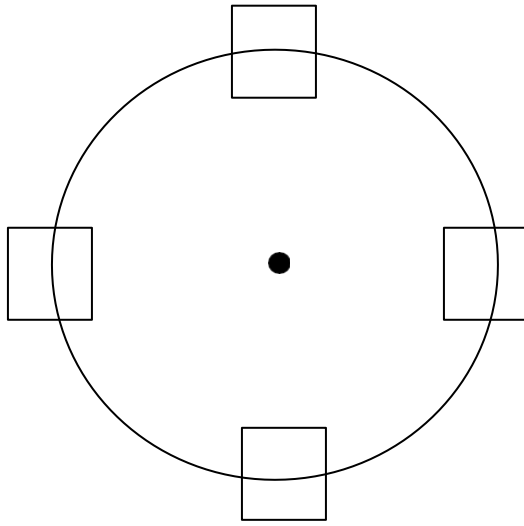
a) The aim of the project is to write a program in C programming language and using OpenGL that will draw a cube with sides of different colors that is located at a certain distance from the camera and rotates around its center and a vector while its size is constantly and smoothly changing from the original to double and vice versa. To construct the cube the following procedure should be followed. Construct a display list which contains the commands to draw a square with side length 2 on the plane $z=1$ such that the center of the square is on the z-axis and its sides are parallel to the x, y axes. Then we use this "building block" and by appropriate movements, rotations and scaling we create the 6 faces of a cube (each of a different colour) with edge dimension a such that its centre coincides with the origin of the axes and its faces are parallel to the planes xy , yz , xz . We then place the cube at the point $(0, 0, -b)$ and set it in continuous rotation with its centre of rotation at its centre - i.e. the point $(0, 0, -b)$ - and with the axis of rotation the vector (v_x, v_y, v_z) , while simultaneously increasing its size as described above using appropriate scaling. To smoothly display the motion, use the double buffering technique, while a depth buffer is used to remove hidden surfaces. Use orthographic projection.

CLARIFICATION: The final result should be a cube which will be is located with its centre fixed at the point $(0, 0, -b)$ and will rotate continuously with its centre of rotation at $(0, 0, -b)$ and its axis of rotation the vector (v_x, v_y, v_z) . Simultaneously with the rotation, the cube grows and shrinks continuously, i.e. its edge changes dimension as follows (the rate of increase/decrease is indicative, choose an appropriate rate so that the fluctuation is smooth): $a, 1.05*a, 1.10*a, \dots, 1.95*a, 2*a, 1.95*a, 1.9*a, \dots, 1.05*a, a, 1.05*a, \dots$

Attention: do not draw the cube directly with design commands in the appropriate position but create it side by side in the way described above.

b) Having written the code for the above case, modify it so that the cube now rotates not with its centre of rotation at its centre but around $(0, 0, -8*b/10)$, with the same axis of rotation as in (a) and with some radius of your choice. The same applies to the size fluctuation as in (a).

CLARIFICATION: The final result should be a cube which will be rotates continuously around a centre of rotation $(0, 0, -8*b/10)$, axis of rotation the vector (v_x, v_y, v_z) and radius of rotation r that you choose. Simultaneously with the rotation, the cube grows and shrinks continuously, i.e. its edge will change dimension as in case (a). For example, if the axis of rotation is $(0,0,1)$, which we assume is perpendicular to the paper/screen, and ignoring for the moment the change in size, the rotation should be:



If it helps, implement the above rotation first before going to the specific axis (v_x, v_y, v_z) and before adding the size increment. Deliver separate code and executable for this case or make a menu selection between the 2 cases.

Parameters:

$(AEM1 + AEM2) \bmod 3 = 0$: $\alpha = 4$, $\beta = 100$, $(v_x, v_y, v_z) = (1, 1, 1)$

$(AEM1 + AEM2) \bmod 3 = 1$: $\alpha = 5$, $\beta = 70$, $(v_x, v_y, v_z) = (1, 2, 2)$

$(AEM1 + AEM2) \bmod 3 = 2$: $\alpha = 6$, $\beta = 90$, $(v_x, v_y, v_z) = (1, 0, 1)$