

Computer Graphics - Programming Exercises

Assignment 1 [5 Points] (Creating a Planet)

In computer graphics, the world is made of polygons, which means that curved surfaces have to be approximated by polygonal faces. In this assignment, you have to create an approximation of a sphere.

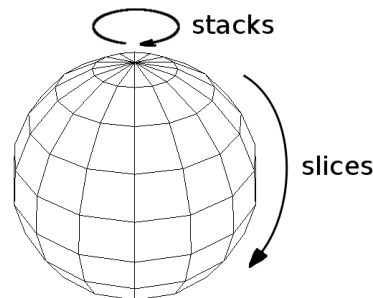
A sphere with radius r can be expressed in spherical coordinates (r, θ, ϕ) where $r \in [0, \infty)$, $\theta \in [0, \pi]$ and $\phi \in [0, 2\pi]$. The cartesian coordinates are computed in the following way:

$$x = r \sin \theta \cos \phi$$

$$y = r \cos \theta$$

$$z = r \sin \theta \sin \phi$$

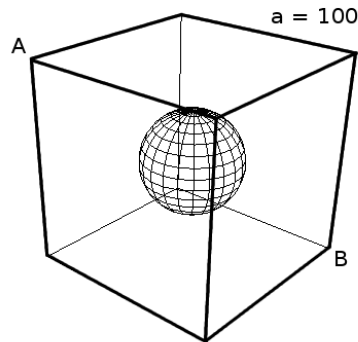
The accuracy of a discrete approximation of a sphere can be controlled by the number of slices and the number of stacks. The first one equates the number of uniform samples along the elevation angle θ and the second one along the azimuth angle ϕ .



- a) Implement the generation of a sphere in the function `drawSphere`, which takes the radius, the number of slices and the number of stacks as input. The center of the sphere is the origin of the coordinate system. [Hint] Use triangle fans for the area around the poles (`GL_TRIANGLE_FAN`) and quad strips for the rest (`GL_QUAD_STRIP`). Make sure that the polygons are correctly oriented. The front of a polygon is always determined by a counter-clockwise orientation of its vertices.

The function is called in the `display()` function with a radius of 25. The number of stacks and the number of slices are global variables which can be increased and decreased by pressing the keys 1-4. The keyboard callback function is already implemented, you find more information in the program skeleton. You also have the functionality to switch the wireframe mode on and off by pressing p (for polygon mode).

- b) Set up the camera in the following way: Consider a cube with an edge length $a = 100$ centered around the origin and aligned with the coordinate axes. Place the camera at one of the corners and let it look down the opposite corner (e.g. points A and B in the subsequent figure). The Projection Matrix should be set in a way such that the camera has a fovy angle of 70° . Make also sure that the near and far plane is set so that the sphere lies entirely inside the view frustum.



Implementation Guidelines

As this is your first assignment you will use the very old fashioned fixed function pipeline. And because (the old) OpenGL is a state machine, setting up geometry and lighting take getting used to. Consulting the OpenGL instructions should be helpful.

Good Luck!

Your source code will be copied from your handin directory on:

Monday, 27.10.2014 14:00 pm

all subsequent changes cannot be taken into account!