Assignment 3: Realistic Rendering Techniques on Parametric Surfaces

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Due Date: December 27, 2019, Friday, Class Hour

Demo Place: BZ-05

Grade Value: 20 %

Requirements

You will do this assignment individually.

In this assignment, you will write a program to draw parametric surfaces (superquadric objects - superquadric toroid, and superquadric hyperboloid of one piece) in wireframe, Gouraud Shaded (per vertex shader), or Phong Shaded (per fragment shader) form, depending on the users choice. The user should be able to specify the size of the object using a suitable interface, like specifying with a bounding box and the exponents determining the shape of the object. Your user interface should have the functionality of camera control (rotation, zoom in/out, etc.)

You will implement the functions to display the surfaces in wireframe, Gouraud shaded and Phong shaded form. You will also use per vertex shader for Gouraud Shading and per fragment shader for Phong Shading. You will also select the one of the following three realistic rendering techniques and implement it as part of the assignment:

- Parametric Texture Mapping
- Bump Mapping
- Environment Mapping

Prepare at least two images of the objects with these techniques applied demonstrating the technique that you implemented.

Bonus: Implementing another technique from the above list.

Superquadrics

See Superellipse and Superquadric Ellipsoid for the formulation and theory of Superquadric objects. You can also see Superquadric toroids in the same page.

You could use the code in the Web page above. But, you should adopt it to you assignments requirements. You cannot use it directly.

For the other superquadric objects (super hyperboloid of one piece), refer to the original paper "Superquadrics and Angle-Preserving Transformations", *IEEE Computer Graphics and Applications*, Vol. 1, No. 1, pp. 11-22, January 1981, (Local Copy).

Another useful reference is the following document: "Superquadrics and Their Geometric Primitives", Ales Jaklic, Ales Leonardis and Franc Solina, in *Segmentation and Recovery of Superquadrics*, Chapter 2, pp. 13-39, *Computational Imaging and Vision*, Vol. 20, Kluwer, Dordrecth, 2000. This contains all the formulations of Superquadrics (Sect.2.2) you need for your assigment.

Superellipsoid Wikipedia.

Superquadrics Wikipedia.