CS 557 Computer Graphics Shaders

Project #1

Step- and Blended-edged Elliptical Dots

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Video Link: https://youtu.be/qTY5XmIstaI

Description:

This project shows the use of GLSL vertex and fragment shaders to create a repeating pattern (elliptical dots) on the surface of a 3D model. The selected model is a sphere generated using the OsuSphere function provided by "osusphere.cpp". The pattern of elliptical dots is achieved by constructing a rectangular grid on the model's texture coordinates (s, t) and plotting ellipses within each grid cell using the ellipse equation. Two variables, uAd (ellipse diameter in s) and uBd (ellipse diameter in t), define the ellipse dimensions. To create smooth edges for these elliptical dots, the uTol variable defines the blend width between the ellipse and the non-ellipse region. The smoothstep function generates a gradient from 0 to 1 for pixels near the boundary within the uTol range. The mix function is then used to blend colors, thus creating a smooth color transition from the ellipse interior to its exterior (smooth edges).

Per-fragment Lighting is implemented with associated variables (uKa, uKd, uKs, and uShininess) using the code from the Project #1 Handout. These lighting variables can be modified through glman. Additional color variables, uEllipseColor and uObjectColor, control the pattern and sphere colors, which can also be adjusted using glman's color palette.

This project can be run using either Glman with "oval.glib" or the GLSL API. An animation was created using a sine function to vary uAd, uBd, and uTol between smaller and larger values, with keyboard controls to toggle the animation for each variable (if using GLSL API):

- Key "a" or "A" – toggle animation for uAd
- Key "b" or "B" – toggle animation for uBd
- Key "t" or "T" – toggle animation for uTol
- Key "f" or "F" – freeze or resume the overall animation

Screenshots:

1. ***Hard-Edged and Smooth-Edged Elliptical Dots by changing uTol***

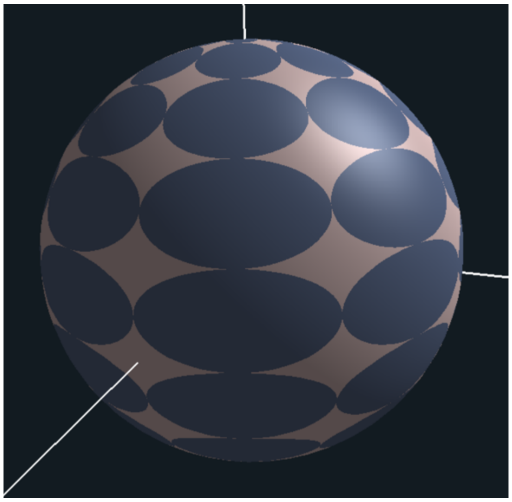

Figure 1. Hard-edged Elliptical Dots with **uTol = 0** and default uAd, uBd

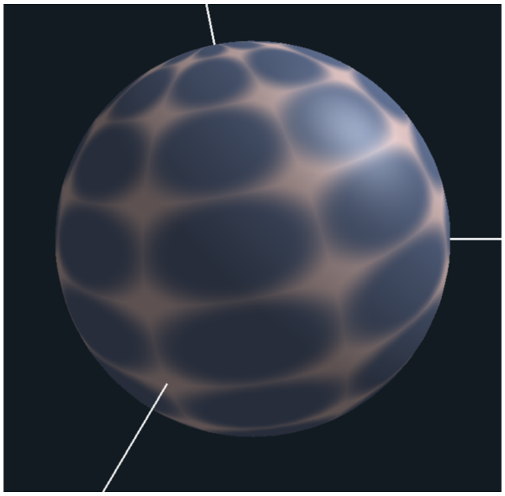

Figure 2. Smooth-edged Elliptical Dots with **uTol = 0.5** and default uAd, uBd

2. *Elongated Elliptical Dots by changing uAd and uBd*

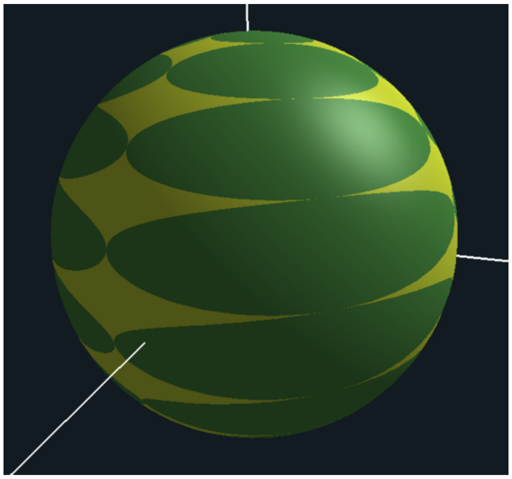

Figure 3. Elliptical Dots with **large uAd** and default uBd

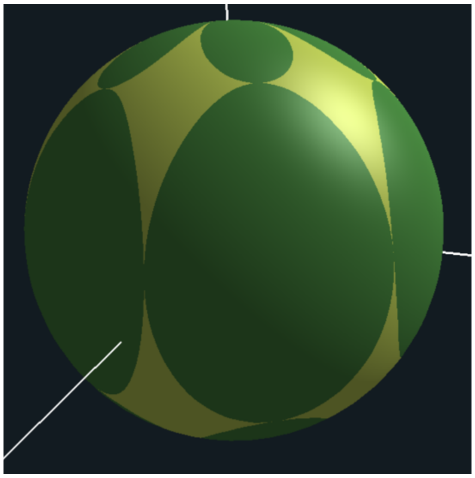

Figure 4. Elliptical Dots with default uAd and **large uBd**

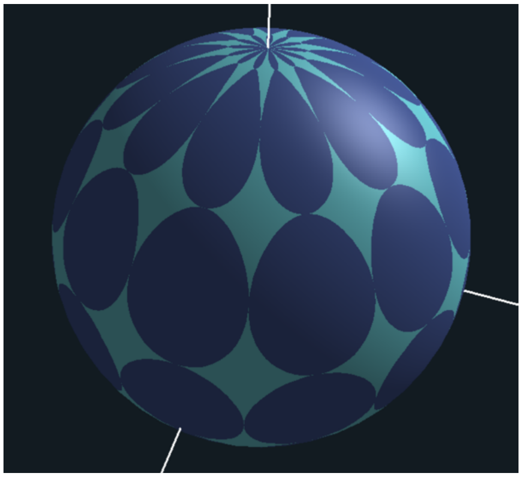

Figure 5. Elliptical Dots with **small uAd** and default uBd

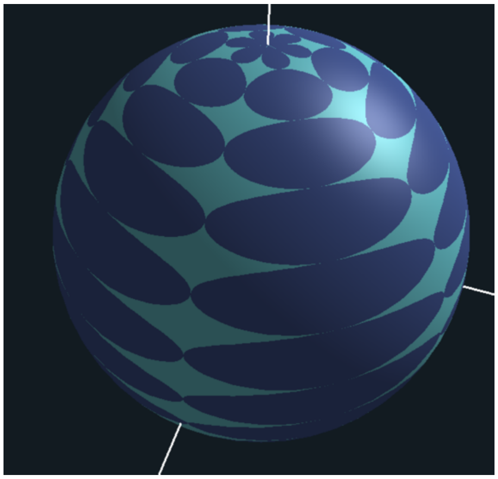

Figure 6. Elliptical Dots with default uAd and **small uBd**

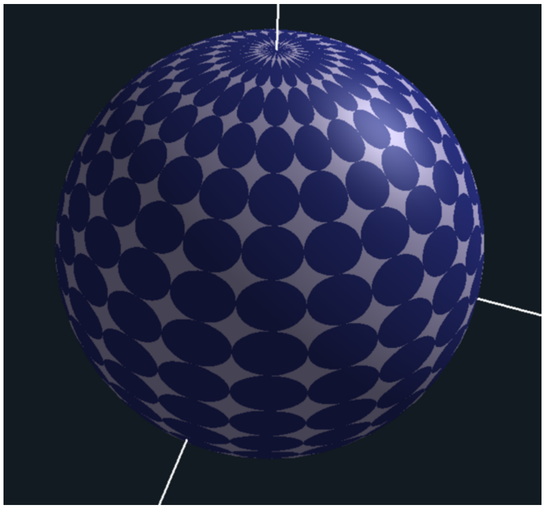

Figure 7. Elliptical Dots with **small uAd** and **small uBd**

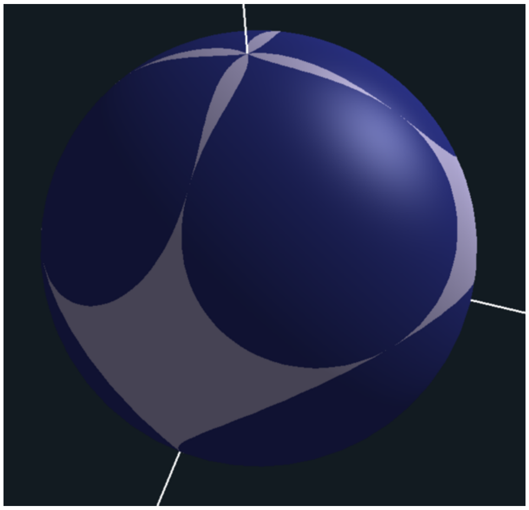

Figure 8. Elliptical Dots with **large uAd** and **large uBd**