3DMODEL

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***Abstract*—Some abstract here**

***Index Terms*—3DMODEL, 3D modeling, lighting, illumination**

I. General math concepts

The following section is meant to refresh the reader with the necessary math concepts to proceed.

1) Producing a vector: To produce a vector L given two points Q and P, perform subtraction on its components.

$$L = \begin{bmatrix} Q_x - P_x \\ Q_y - P_y \\ Q_z - P_z \end{bmatrix} = \begin{bmatrix} Q_x \\ Q_y \\ Q_z \end{bmatrix} - \begin{bmatrix} P_x \\ P_y \\ P_z \end{bmatrix} \tag{1}$$

2) Acquiring the magnitude of a vector: The magnitude of a vector is intuitively its length. It is a scalar value. The norm or the magnitude of a vector L is defined as:

$$|L| = \sqrt{L_x^2 + L_y^2 + L_z^2} \tag{2}$$

3) Producing a unit vector: The unit vector can be acquired by dividing the components (x, y, z) by the magnitude.

$$\hat{L} = \frac{1}{\|L\|} \tag{3}$$

4) Acquiring the dot product of vectors: The dot product is a scalar value. It is acquired by getting the sum of the products of the vectors' components. Given two vectors A and B, the dot product is defined as following:

$$A \cdot B = \sum_{i=1}^{n} A_i B_i = A_1 B_1 + A_2 B_2 + \cdots + A_n \cdot B_n \tag{4}$$

For example, given a 3 dimensional vector like in the case of 3 dimensional position, the dot product between vectors Q and P are defined as the following:

$$Q \cdot P = Q_x P_x + Q_y P_y + Q_z P_z$$

The dot product of vectors A and B is also defined as:

$$N \cdot L = \|N\| \, \|L\| \, cos(\theta) \tag{5}$$

5) Illumination:

$$I = I_a K_a = f_{att} \cdot I_d \cdot K_d \cdot N \cdot L + f_{att} \cdot I_s \cdot K_s \cdot (R \cdot V)^{\alpha} \tag{6}$$

Note that since N and L are unit vectors, the cross product of N and L

$$f_{att} \cdot I_d \cdot K_d \cdot cos(\theta) \tag{7}$$

Set K_a to $(1, 0, 0)^T$ to make a material red such that multiplying

Ia = ambiance Id = diffuse Is = specular

Realistic effect Id == Is

n = normal unit vector r = perfect reflection of light unit vector v = viewer unit vector l = light unit vector

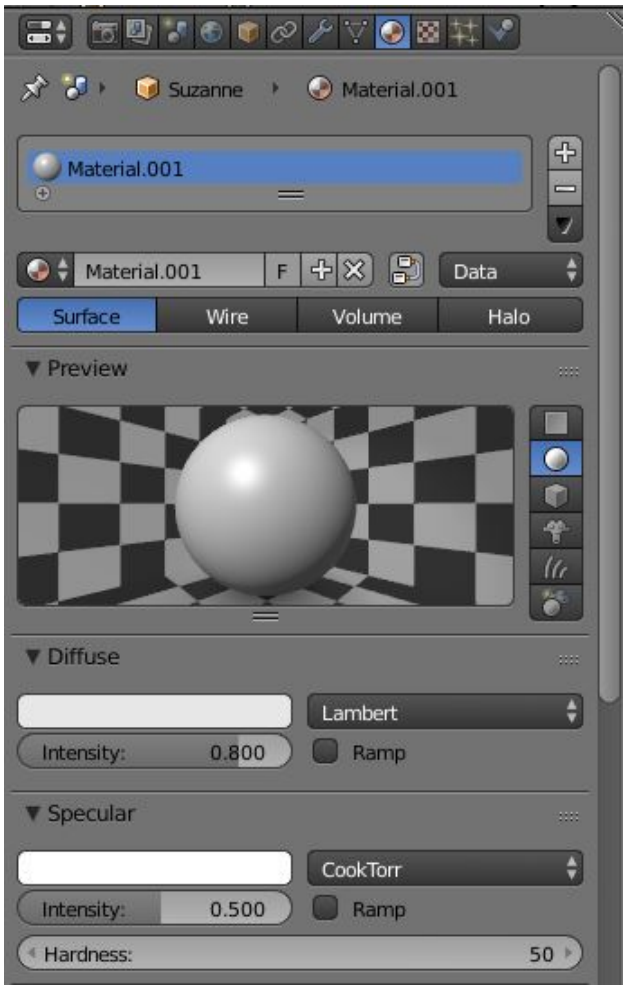

Fig. 1. Caption

A. Subsection Heading Here

II. Lighting and illumination

1) Illumination: The attenuation is defined as f_{att}, which is a factor that affects the diffuse and specular intensities as seen in 8.

$$f_{att} = min(1, \frac{1}{a + b \cdot d_l + c \cdot d_l^2}) \tag{8}$$

The coefficients b represents the inverse linear coefficient, and c is the inverse quadratic coefficient.

A. Subsection Heading Here

III. Conclusion

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APPENDIX A
PROOF OF THE FIRST ZONKLAR EQUATION

Some text for the appendix.

ACKNOWLEDGMENT

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REFERENCES

[1] H. Kopka and P. W. Daly, *A Guide to LaTeX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.