

CS 557 Assignment Three: Displacement Mapping, Bump Mapping, and Lighting

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Link: [CS557 Assignment Three - OSU MediaSpace \(oregonstate.edu\)](#)

Project Description:

In the vertex shader, the key operation is the modification of the z-coordinate of vertices to simulate the roughness of a rock surface. This effect is achieved by applying a mathematical formula that creates undulations on the surface, mimicking the natural unevenness of rocks. The formula uses parameters (u_A , u_B , u_C , u_D) that control the amplitude and wavelength of these undulations, allowing for customizable rock textures. Additionally, the shader computes the normals for these vertices, which are crucial for accurate lighting in the fragment shader. It also calculates texture coordinates, and vectors from each vertex to the light source and viewer.

The fragment shader focuses on rendering the surface with realistic lighting. It uses a technique to perturb the normals based on a 3D noise texture, creating a bump mapping effect. This noise-driven perturbation introduces variations in the surface normals, simulating the irregularities of a rock surface. The shader then performs lighting calculations using these perturbed normals, incorporating ambient, diffuse, and specular lighting components. The interplay of these components, modulated by the rock's texture and the noise-induced variations, results in a dynamic and realistic rendering of the rock surface. The specular highlights and shadows generated by these calculations add depth and realism to the appearance of the rock.

Project Screenshot:

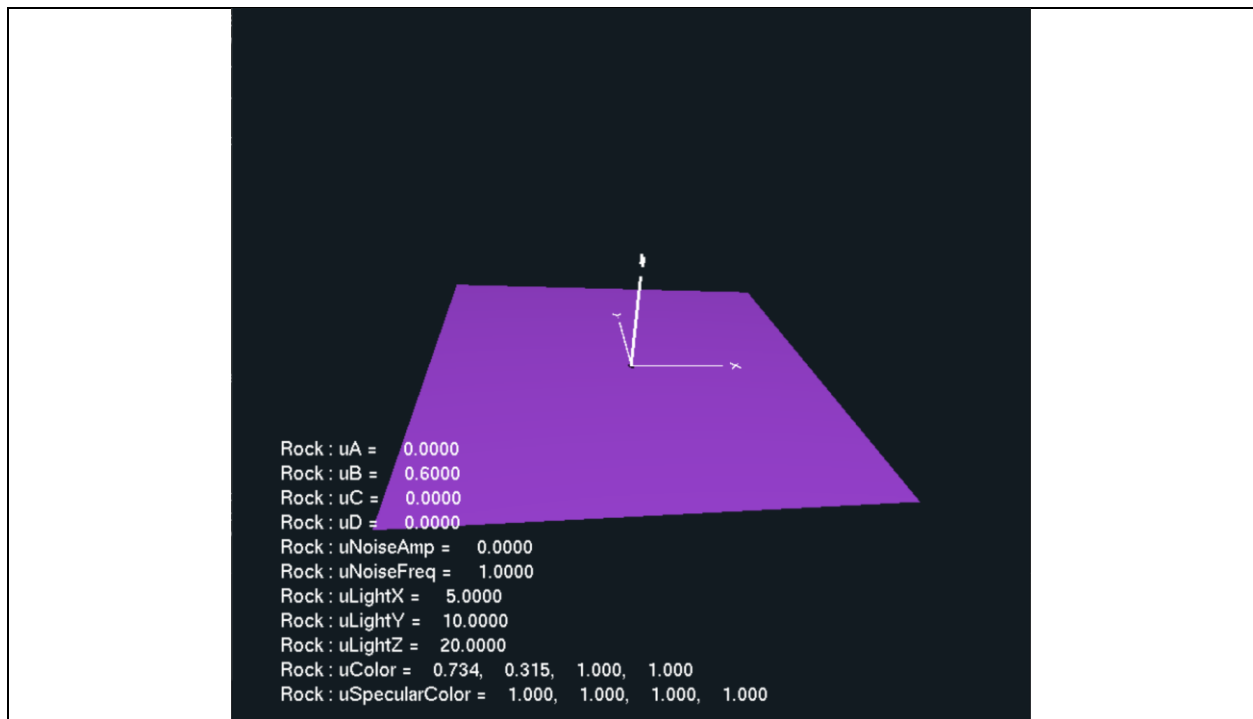


Figure One: Original

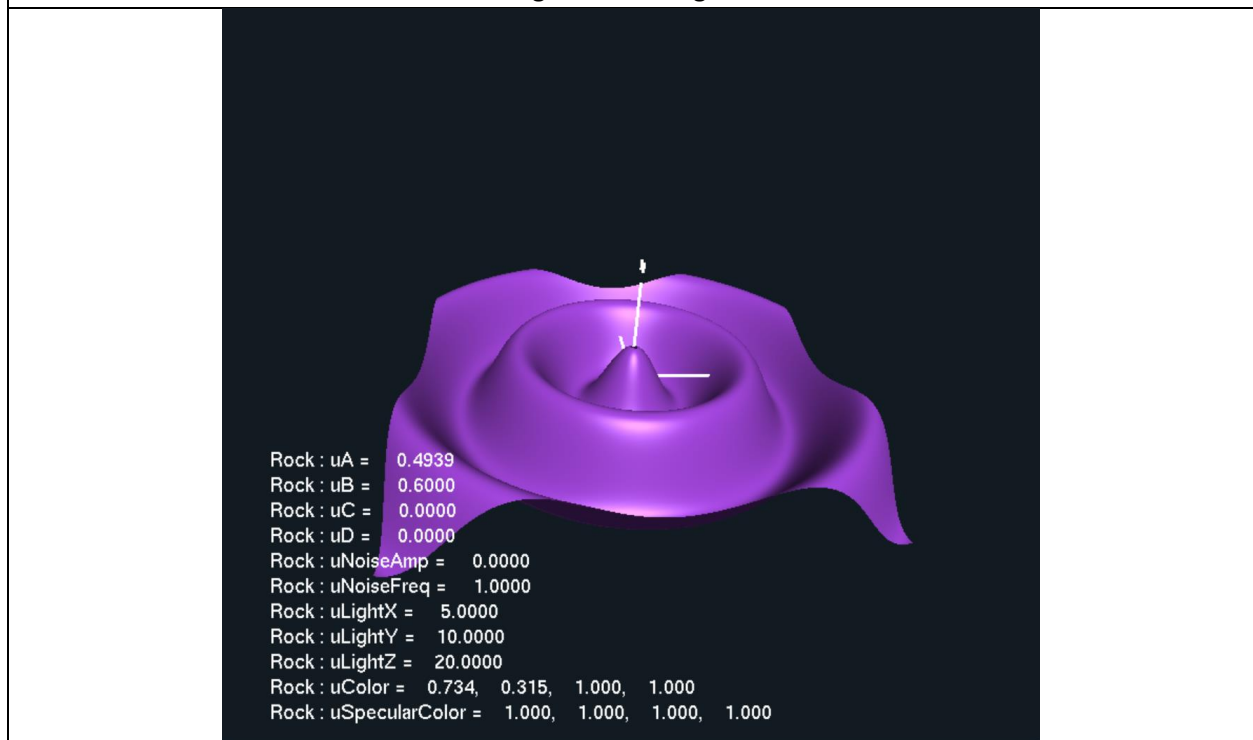


Figure Two: Changing uA

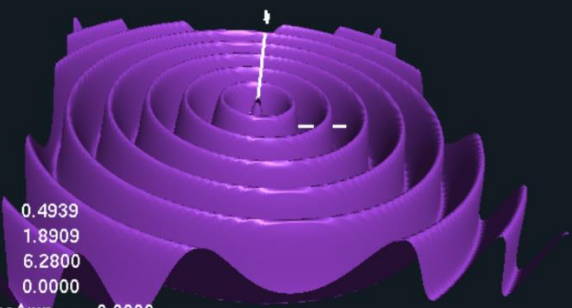


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Rock : uA = 0.4939
Rock : uB = 1.8909
Rock : uC = 0.0000
Rock : uD = 0.0000
Rock : uNoiseAmp = 0.0000
Rock : uNoiseFreq = 1.0000
Rock : uLightX = 5.0000
Rock : uLightY = 10.0000
Rock : uLightZ = 20.0000
Rock : uColor = 0.734, 0.315, 1.000, 1.000
Rock : uSpecularColor = 1.000, 1.000, 1.000, 1.000

```

Figure Three: Changing uB

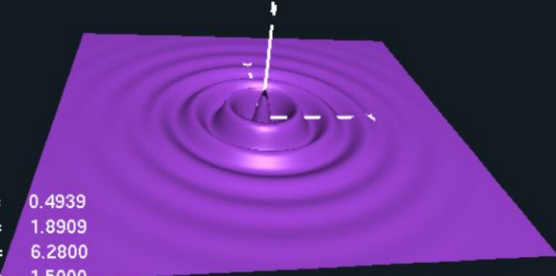


```

Rock : uA = 0.4939
Rock : uB = 1.8909
Rock : uC = 6.2800
Rock : uD = 0.0000
Rock : uNoiseAmp = 0.0000
Rock : uNoiseFreq = 1.0000
Rock : uLightX = 5.0000
Rock : uLightY = 10.0000
Rock : uLightZ = 20.0000
Rock : uColor = 0.734, 0.315, 1.000, 1.000
Rock : uSpecularColor = 1.000, 1.000, 1.000, 1.000

```

Figure Four: Changing uC

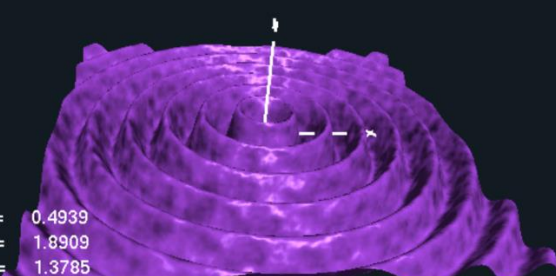


```

Rock : uA = 0.4939
Rock : uB = 1.8909
Rock : uC = 6.2800
Rock : uD = 1.5000
Rock : uNoiseAmp = 0.0000
Rock : uNoiseFreq = 1.0000
Rock : uLightX = 5.0000
Rock : uLightY = 10.0000
Rock : uLightZ = 20.0000
Rock : uColor = 0.734, 0.315, 1.000, 1.000
Rock : uSpecularColor = 1.000, 1.000, 1.000, 1.000

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Figure Five: Changing uD



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Rock : uA = 0.4939
Rock : uB = 1.8909
Rock : uC = 1.3785
Rock : uD = 0.3049
Rock : uNoiseAmp = 2.3476
Rock : uNoiseFreq = 1.0000
Rock : uLightX = 5.0000
Rock : uLightY = 10.0000
Rock : uLightZ = 20.0000
Rock : uColor = 0.734, 0.315, 1.000, 1.000
Rock : uSpecularColor = 1.000, 1.000, 1.000, 1.000

```

Figure Six: Changing uNoiseAmp

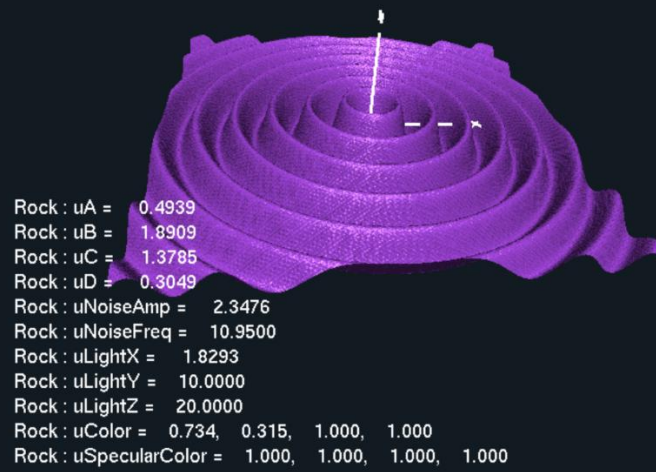


Figure Seven: Changing uNoiseFreq

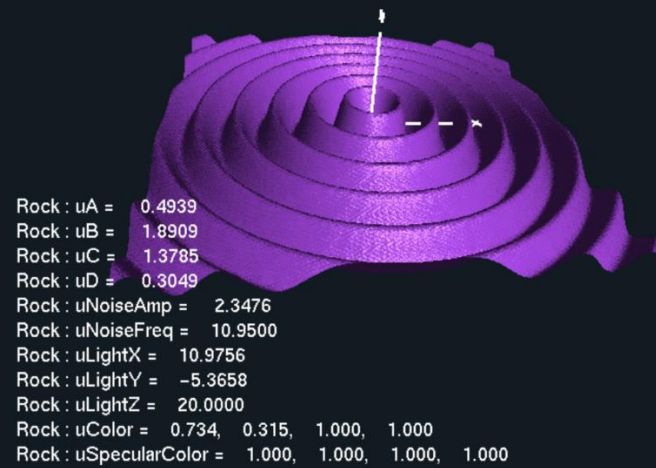


Figure Eight: Changing uLightX&Y

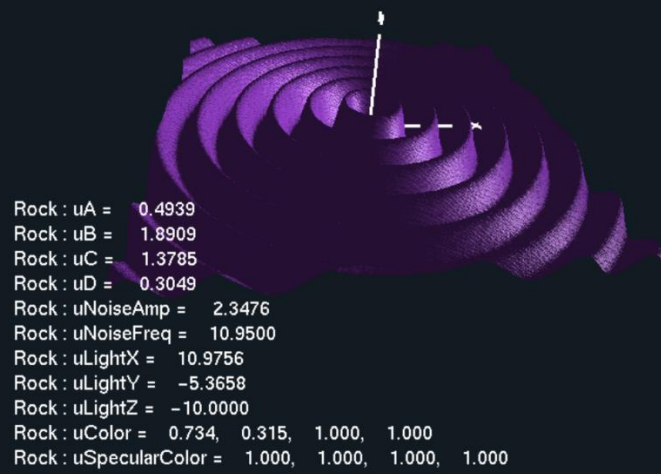


Figure Nine: Changing uLightZ