

CS 557 Assignment Four: Cube Mapping Reflective and Refractive Bump-mapped Surfaces

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Link: [CS 557 Assignment 4 - OSU MediaSpace \(oregonstate.edu\)](#)

Project Description:

In this project, I designed and implemented a shader program using GLSL to simulate dynamic ripple effects on 3D objects, focusing on the interplay of light, reflection, and refraction to create a realistic water surface. I began by manipulating vertex positions in the vertex shader (`gl_Position = gl_ModelViewProjectionMatrix * newVertex;`) to generate wave-like deformations based on mathematical formulas (`newVertex.z = uA * cos(TWO_PI * uB * r) * exp(-uD * r);`), ensuring the visual effect of ripples spreading across the object's surface. In the fragment shader, I applied complex lighting calculations, utilizing noise textures (`vec4 nvx = texture(Noise3, uNoiseFreq * vMC);`) to disturb the water's surface normals (`Normal = RotateNormal(angx, angy, Normal);`), enhancing the realism of reflections and refractions. I meticulously adjusted uniform variables, such as the indices of refraction (`vec3 refractVector = refract(Eye, Normal, uEta);`) and noise parameters (`angx *= uNoiseAmp;`), to fine-tune the appearance of the water, achieving a delicate balance between realism and computational efficiency. The culmination of these efforts was a visually compelling ripple effect, rendered in real-time (`gl_FragColor = mix(refractColor, reflectColor, uMix);`), that could be easily integrated into 3D scenes for enhanced graphical fidelity.

Project Screenshot:

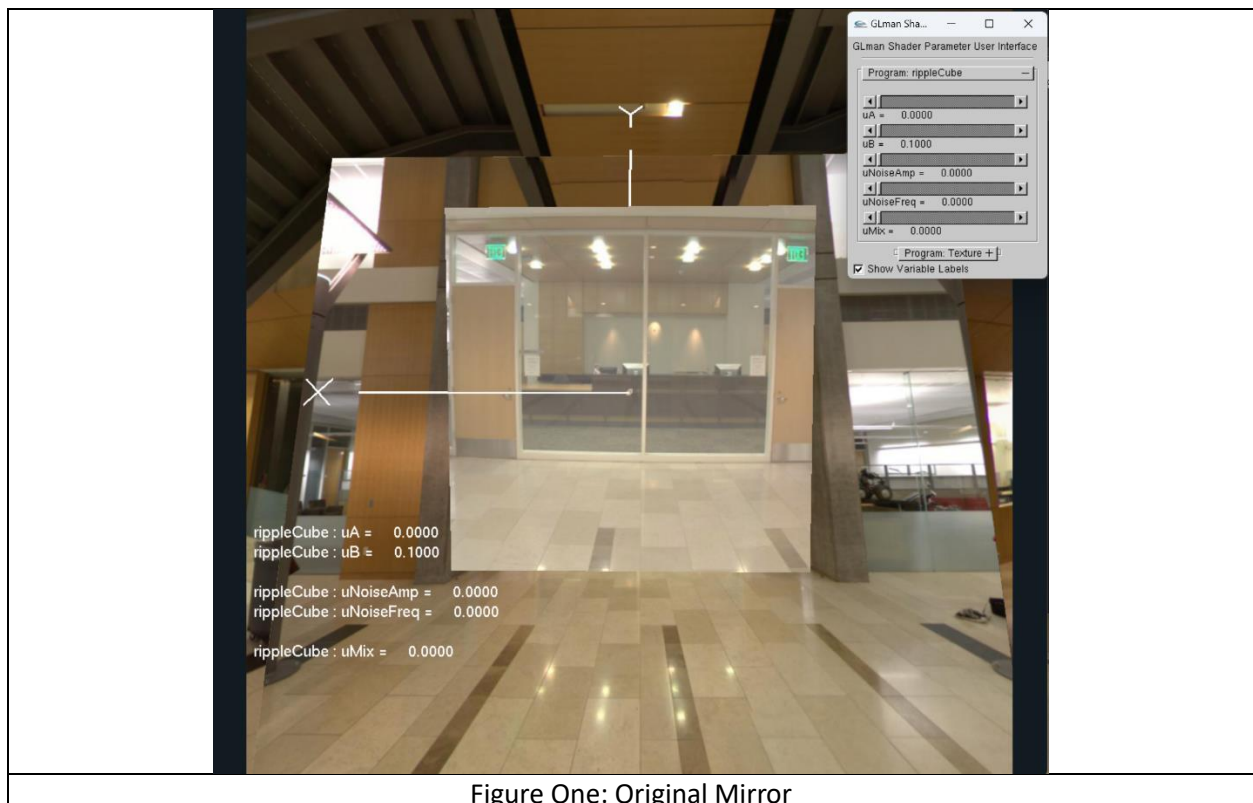


Figure One: Original Mirror

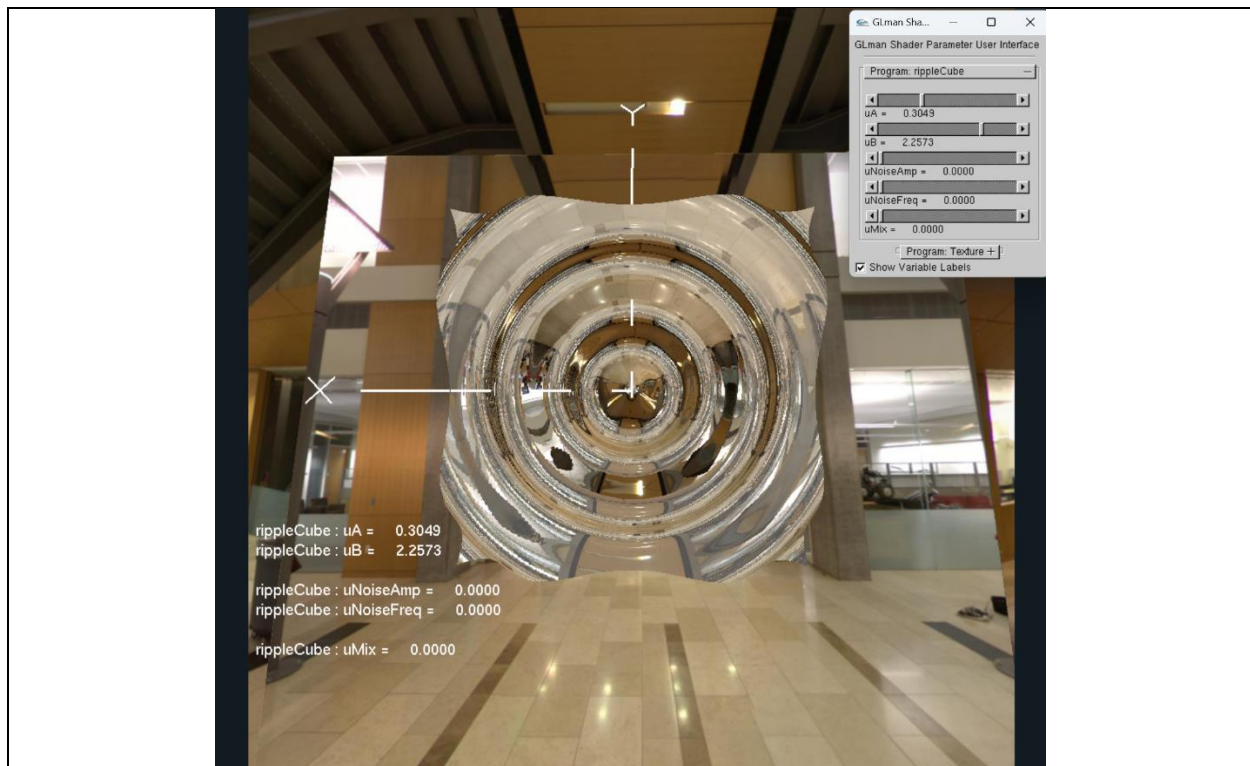


Figure Two: Displacement

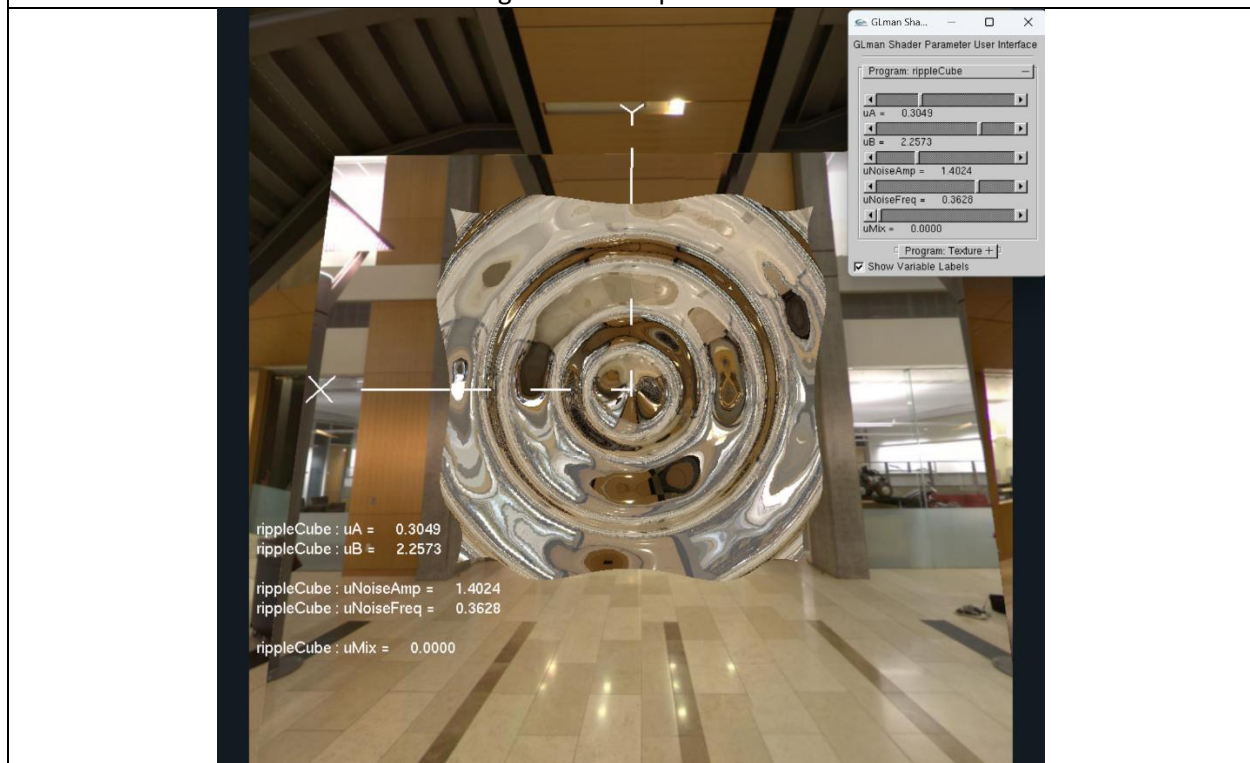


Figure Three: Noise Bump-mapped

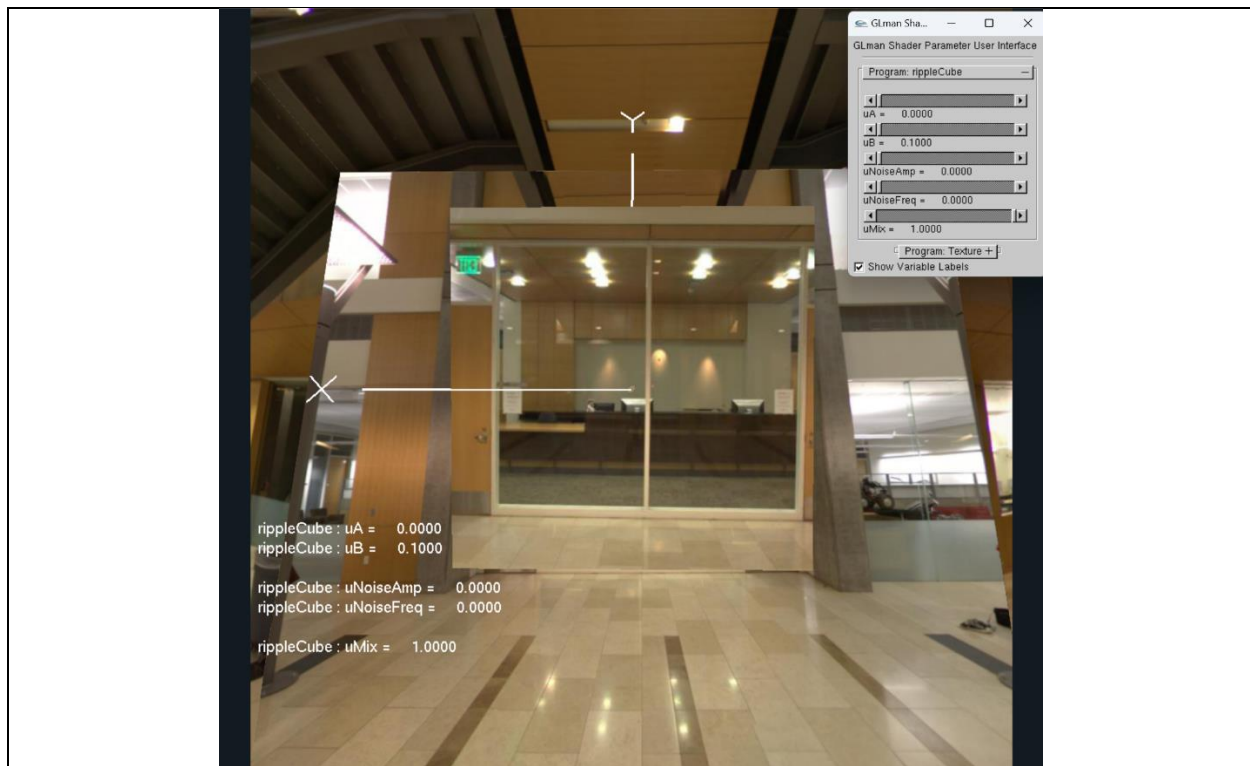


Figure Four: Original Mirror with Reflection

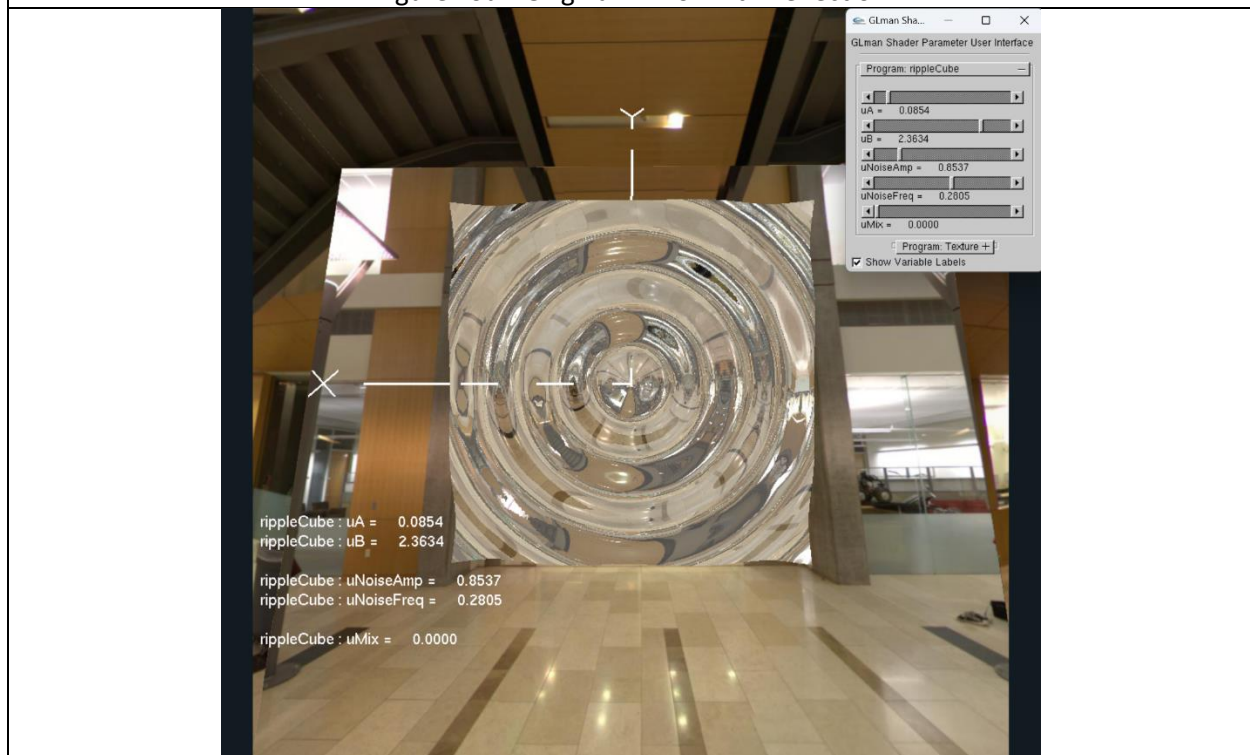


Figure Five: Bump-mapped without Reflection

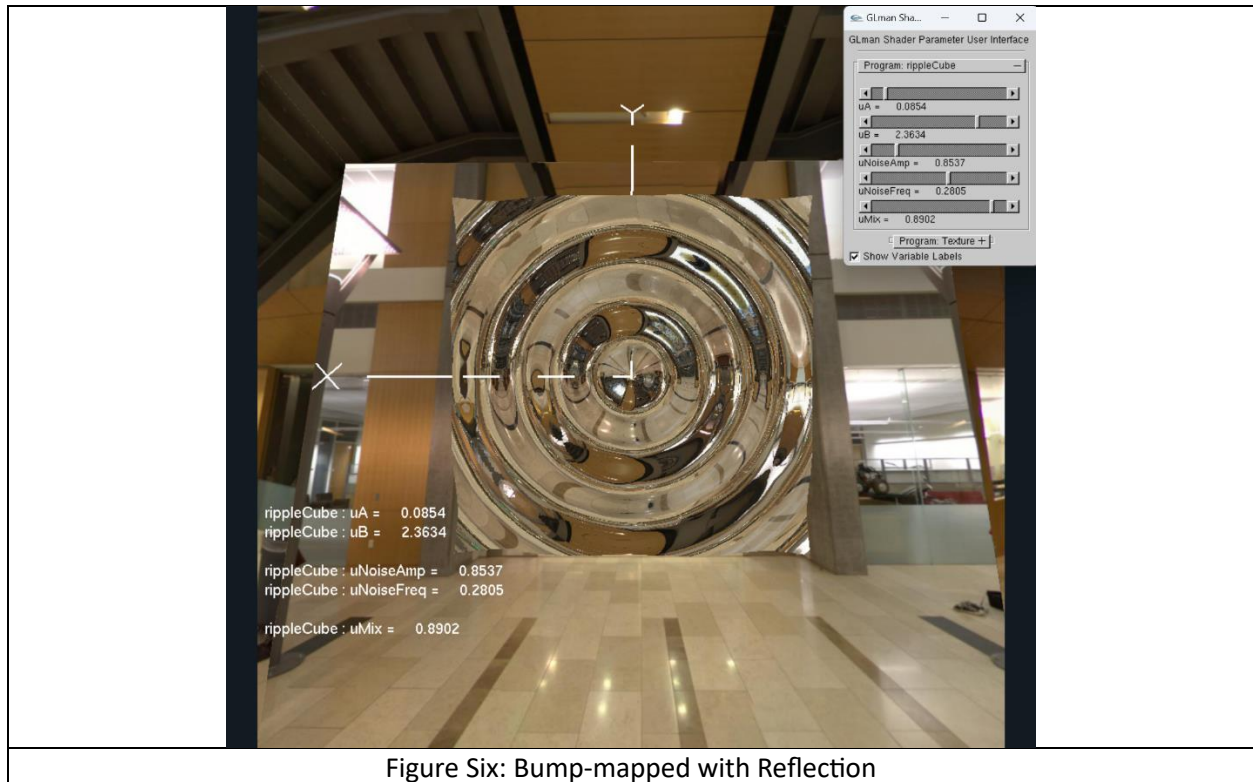


Figure Six: Bump-mapped with Reflection