700119 ACW Report

## 001_CWRK: ACW1: Procedural Visual Effects in HLSL

Date: 17th Apr' 2023

1. Underwater environment:

Surface waves on the horizon are created by **ray marching** a signed distance function.

Multi octave noise is used to create a **fractal** pattern to modulate the surface height of the water waves.
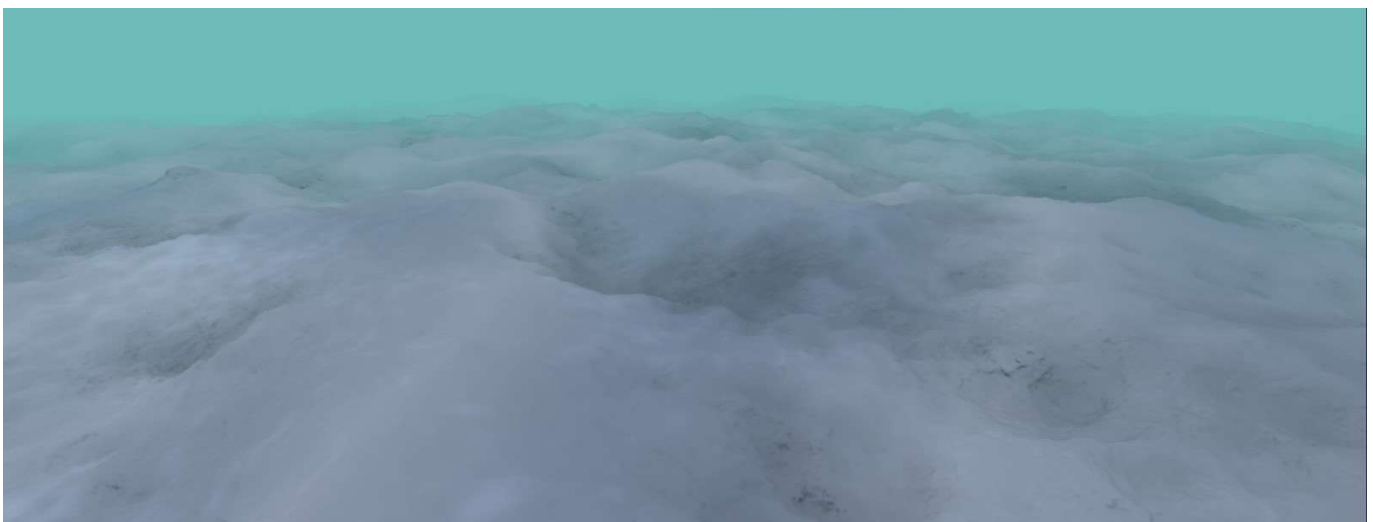
Additionally, volumetric lighting, water caustics and distance based fog are implemented as part of advanced effects.
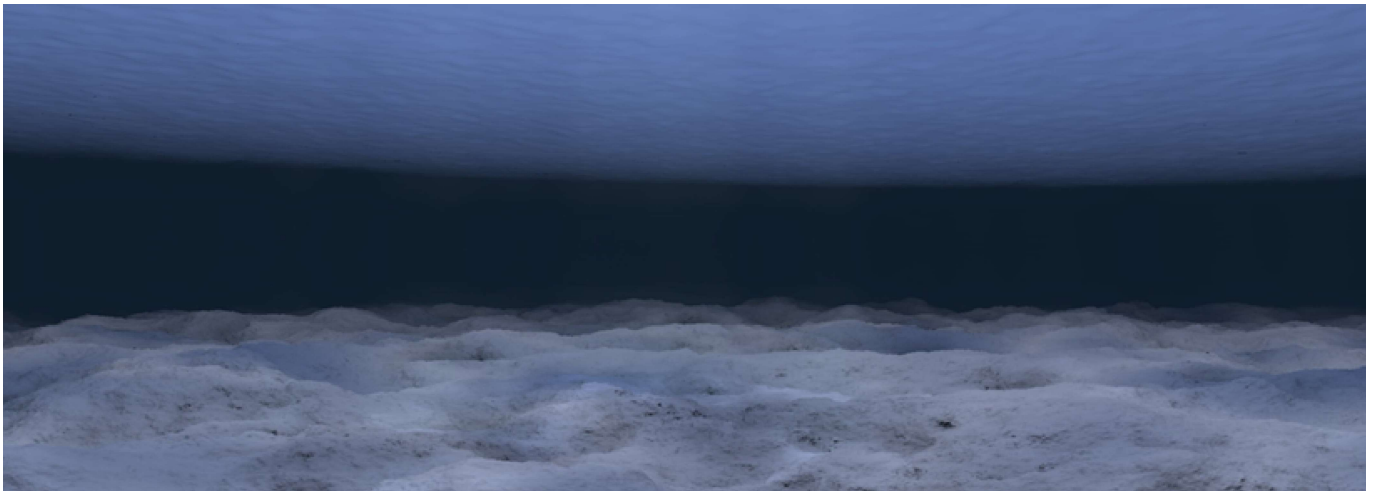

2. Procedural sea floor:

The terrain is implicitly modelled by **ray marching** a signed distance function.

Multi octave noise is used to create a **fractal** pattern to create a realistic looking texture for the seafloor.
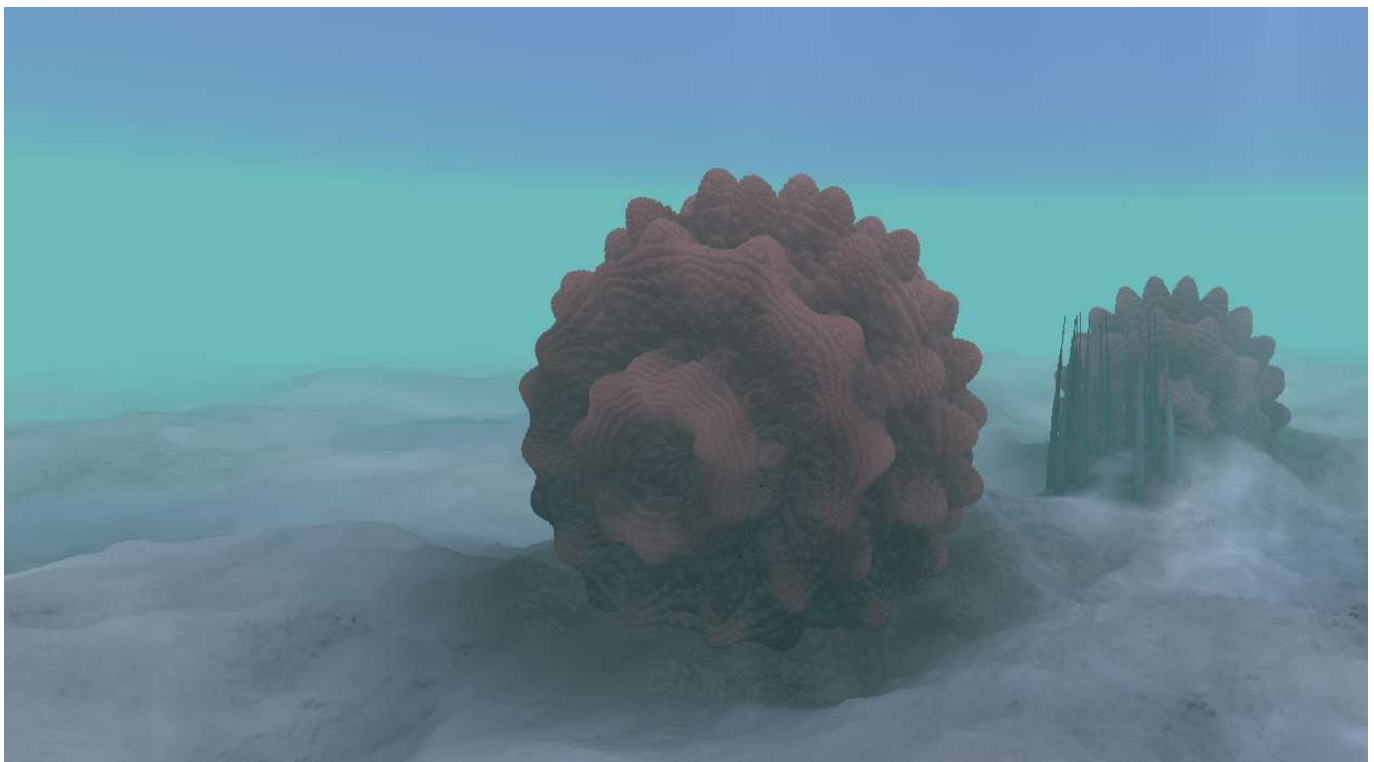
3. 1. Vertex shader-based coral object:

Coral object is created explicitly by generating a list of points sampled from a unit sphere and repositioning them in the vertex shader.
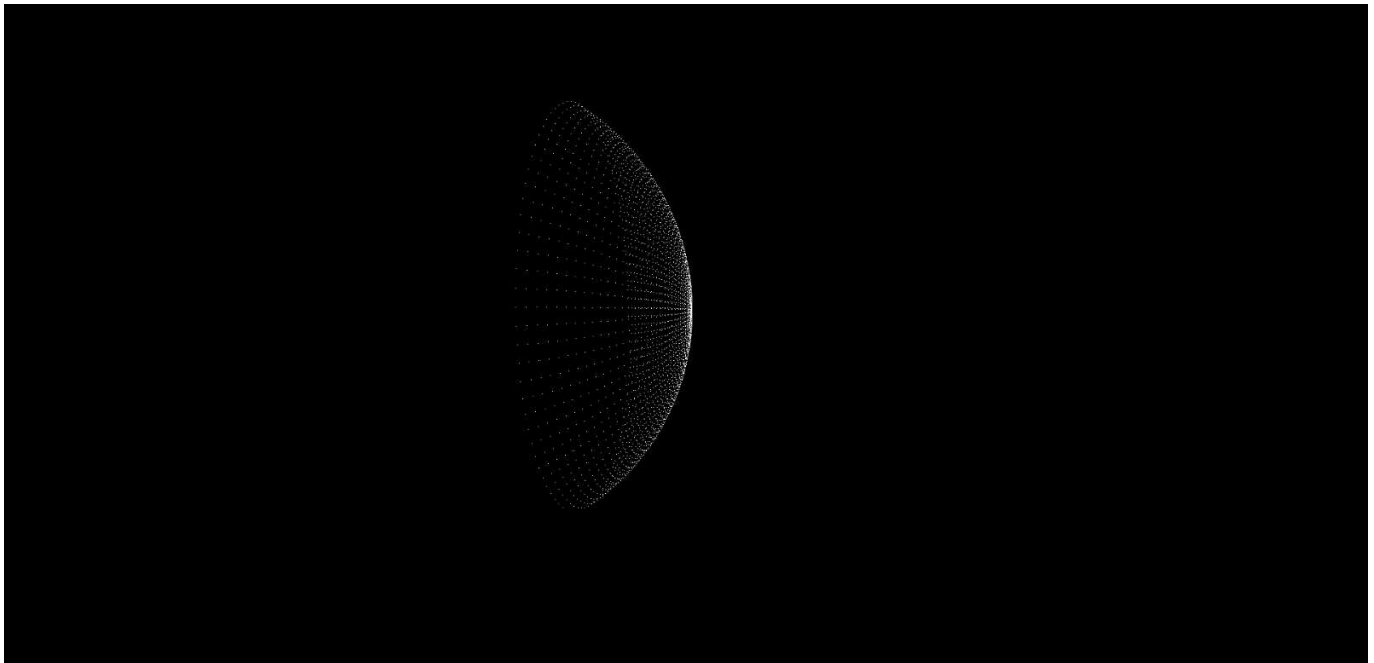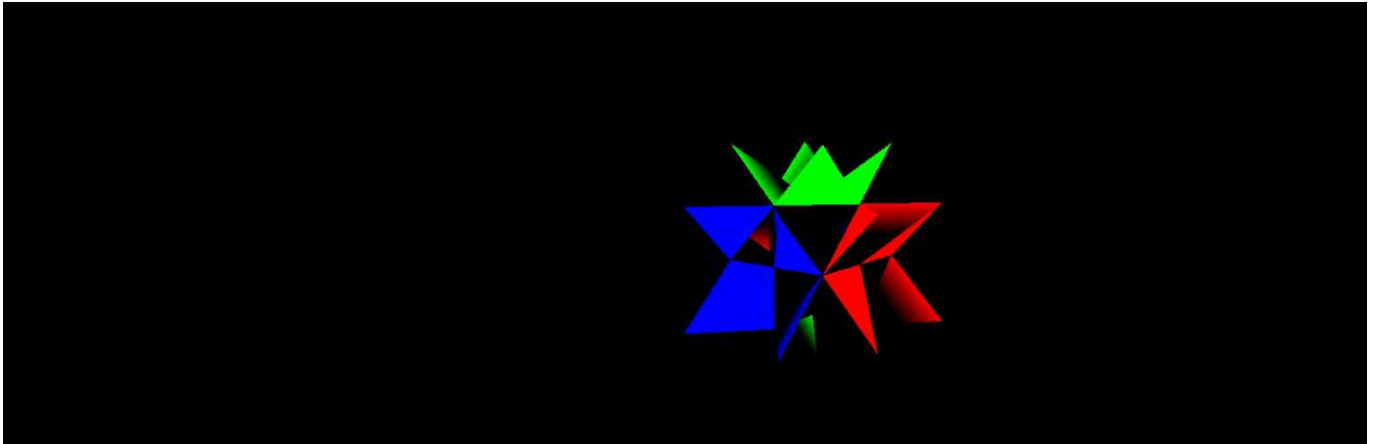

3. 2. Pixel shader-based coral object:

Implicitly modelled the coral object using a signed distance function based on the **mandelbulb** derivative.

3. 3. Geometry shader-based coral object:

Explicitly modelled using a simple triangle mesh and refining the input mesh using a geometry shader to expand its geometry.

3. 4. Hull and domain shader-based coral objects:

Explicitly modelled coral objects as parametric surfaces directly using hull and domain shaders.

Additionally, controls are implemented to adjust tessellation as well as noise strength for these coral objects, as well as an option to view them in wireframe mode is available.
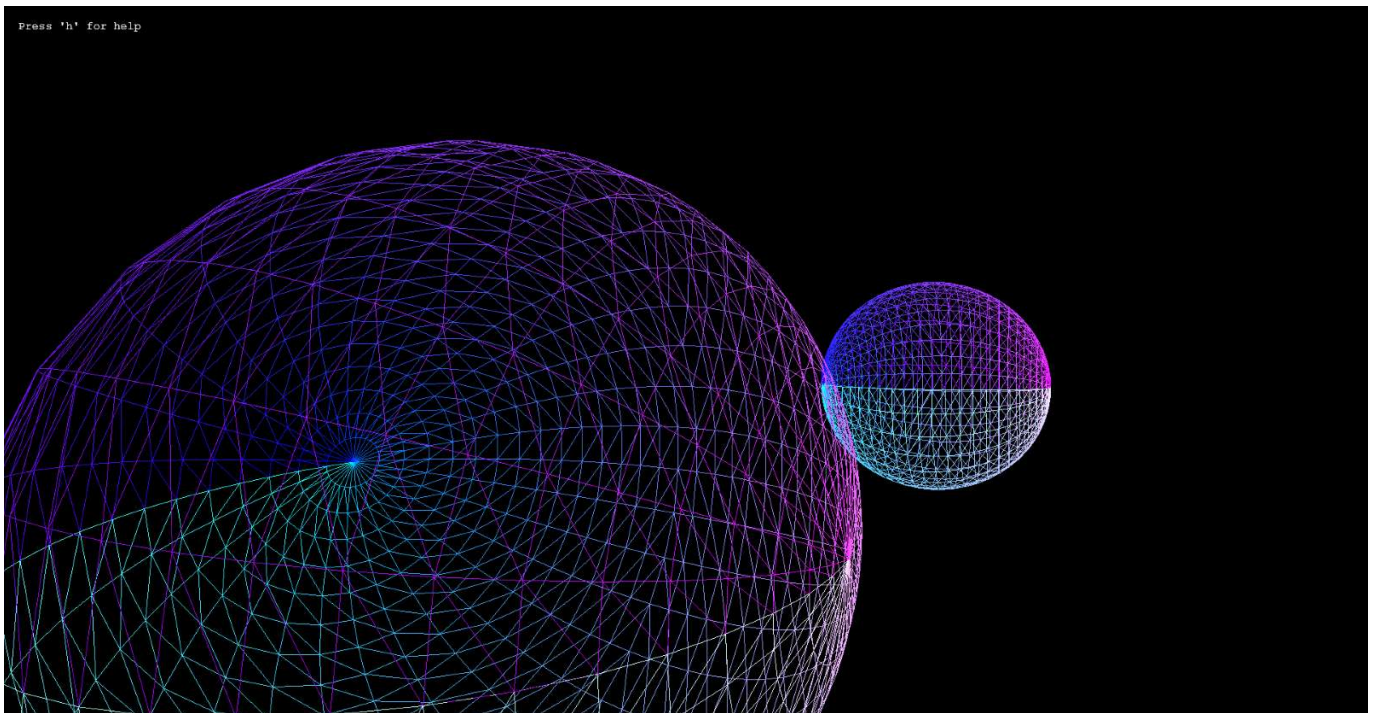
4. Reflective bubbles:

Implicitly modelled a collection of shiny bubbles emitted from the coral floor using a signed distance function.
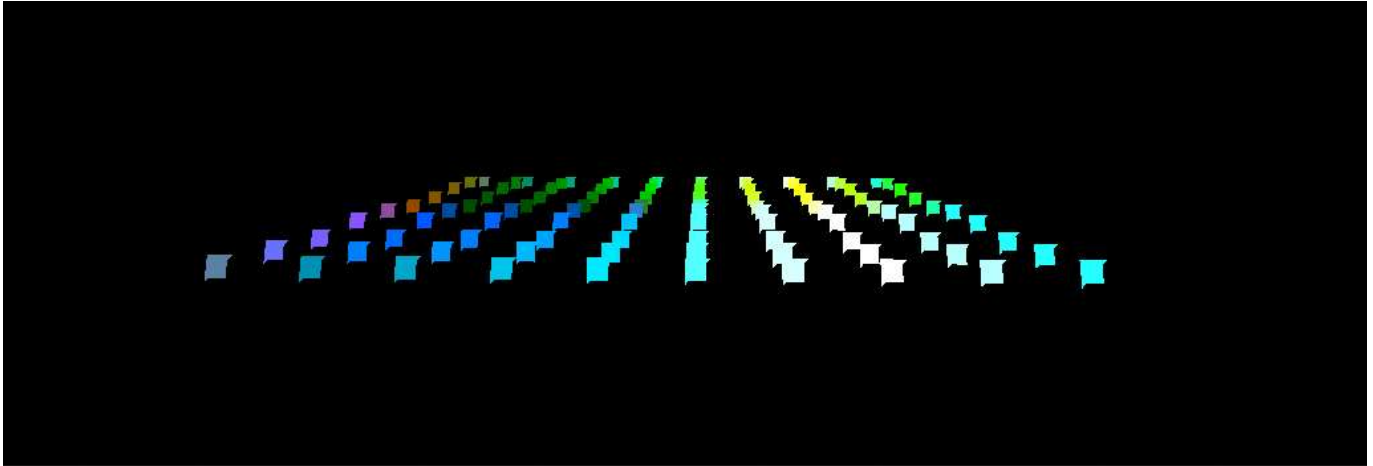
Additionally, added **noise offset** to create **a wobbly non-spherical bubble.**
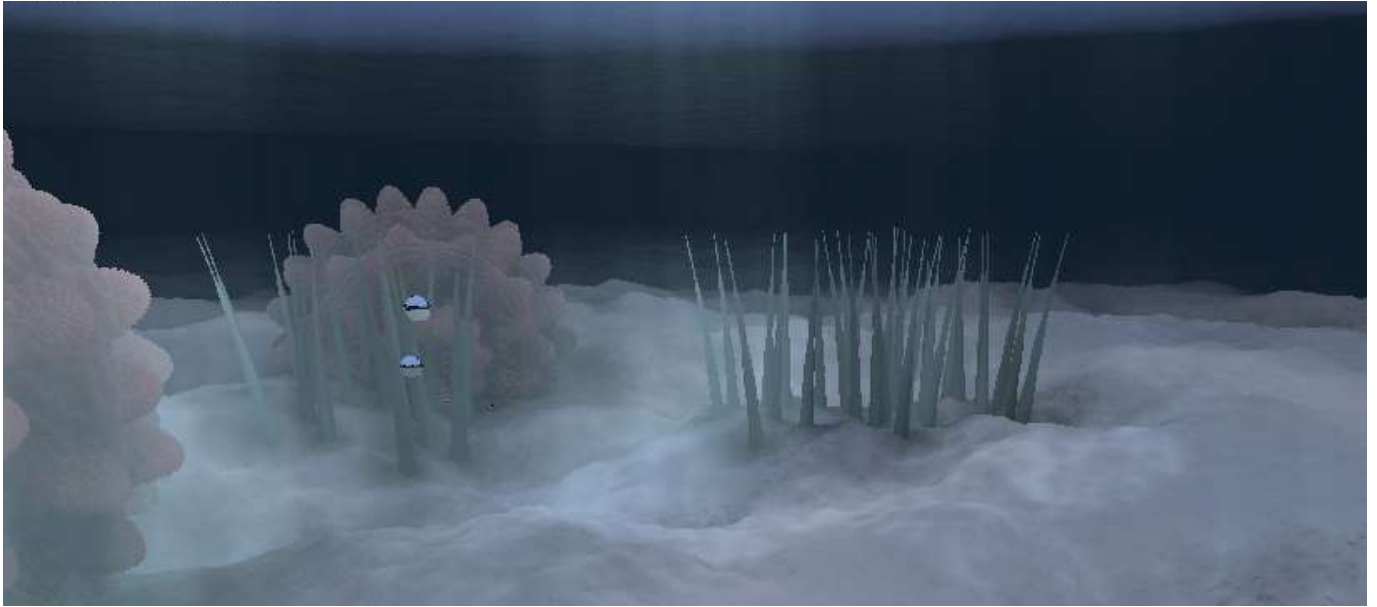
5. A shoal of colourful coral reef fish:

Explicitly created particle system by transforming a single point into a quad using geometry shader.

Additionally, the fishes have been animated using sinusoidal waves.

6. Implicit sea plant modelling and animation:

Implicitly modelled plants using a signed distance function and visualised using the ray marching technique.

6. Novelty and own effects:

- Implemented **volumetric light rays**, and **water caustics.**
- Distance based **fog effect**.
- All graphic objects are properly illuminated using various techniques such as **phong illumination, ambient occlusion and soft shadows.**
- Colour blending and gamma correction.
- As an adv. effect bubbles created are of **non-spherical wobbly shape** and reflect the environment.
- Simulation controls are added to better explore the scene.
- Additionally, day and night render modes are available.