1. VFX Production Pipeline

- Footage
- Composition
- Tracking
- Passes Rendering
- Dynamic Mesh Builder (LoD)
- Displacement Simulation
- Lighting/Shading
- Normals Simulation

2. Dynamic Mesh Builder

The user can select 3 options of Level of Detail algorithms:

- Radial LoD [1]
- GeoClipMap LoD [2]
- Projected Grid LoD [3]

3. Displacement and Normals Simulation

- Gerstner Wave Model
  
  \[ P(x, z, t) = \sum_{n} \left( A \cdot \sin \left( \omega \left( \frac{B_x}{2} \cdot (x - x_0, z - z_0) \right) + \varphi \right) \right) \]

- Statistical FFT Wave Model
  
  \[ h(x, t) = \sum_{k} \left( A \cdot \sin \left( \omega \left( \frac{B_x}{2} \cdot (x - x_0) \right) + \varphi \right) \right) \]

4. Lighting and Rendering

The water shading uses a Fresnel approach to combine reflections and refractions, and also handle underwater fog and caustics. The real-time version uses reflection and refraction maps and the final OptiX version uses raytracing and adjust the reflections according surface normal. Finally we export the final image with multiple passes (normal, reflection, refraction, zdepth and others) for post processing.

5. Results

The system can combine multiple layers of different techniques to produce displacements or normal maps. This allows artist to create a specific ocean shape, like big waves with Gerstner, and control each wave parameter and combine with a random wave model to reduce tile effects. Moreover, the parameters can be changed in real-time using DirectX Shaders, and finally we can render it using OptiX.

References