Tiled Directional Flow

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1 Introduction

For a real-time visualization of one of the Dutch harbors we needed a realistic looking water surface. The old shader showed the same waves everywhere, but inside a harbor waves have many different directions and sizes. To solve this problem we needed a shader capable of visualizing flow. We developed a new algorithm called Tiled Directional Flow which has several advantages over other implementations.

2 Our Approach

Our contribution is a new algorithm, implemented in a shader that generates overlapping tiles. We used a low resolution flow texture for local speed, direction and size of the waves. Within a tile, the speed, direction and size of the waves is constant, so there is no problem with animating the waves, as this can simply be implemented using a sliding normalmap. Using overlapping tiles, each point has a contribution of four normals. Adding the different normalmaps of each tile together results in nice animated waves, which don’t look like sliding normalmaps anymore. The contribution of each tiles goes slowly to zero near the edge of the tile. This would result in a visible effect, because the addition of many normalvectors together tends to create a more upright vector. In the shader this is prevented by assuming the waves behave like noise and by scaling the normal to compensate for this effect (adding N noise sources together, each with amplitude A creates a noise with an amplitude of sqrt(N)*A).

To maximize the area where each tile adds to the animation of the waves, the contribution doesn’t go linear to zero, but with a third power. Note that the blendfactor doesn’t change over time and avoids the pulsating behaviour from Vlachos implementation.

The end result is a very visually appealing animation that shows a strong correlation to the flow direction, even when the frame stops.

A short video explaining the algorithm and a link to the source code can be found at http://goo.gl/R2Byt. and http://goo.gl/gvct.

Related work

Alex Vlachos, “Water Flow in Left 4 Dead 2”, Siggraph presentation, 2010