LARGE-SCALE INTERACTIVE WATER SIMULATION WITH DIRECTIONAL WAVES

Real-Time Live!

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Simulating large bodies of water in real time has been a research goal for a few decades. Existing procedural approaches like FFT-based simulations typically lack dynamic response like boundary-wave reflections or general body-fluid interactions like splashes or boat wakes. On the other side of the spectrum, existing dynamic Eulerian wave simulations suffer from high memory consumption required for adequate grid sizes in large scenes. Dynamic Lagrangian simulations like wave particles suffer from a potentially prohibitive particle count.

This work demonstrates how to couple a very coarse Eulerian wave-energy simulation with a special “up-res” technique to model actual waves, including boundary reflections and diffraction. The “up-res” technique uses wave-energy data to locally attenuate directional waves. The key idea here is a very fast method for superimposing thousands of directional waves at any spatial location, which simulates practically unlimited small wave details at real-time frame rates. The result is the first-ever real-time simulation of a realistic, large-scale ocean scene of 4 × 4 kilometers at a resolution of less than one centimeter. The waves interact with 1,000 boats and floating rigid bodies, and they accurately disperse, diffract, and reflect off island boundaries.

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