

Raging Rapids Rides



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This scene of a river flowing through a rough valley achieves a level of realism not seen before in real time. The river exhibits a variety of medium- and small-scale details, including breaking waves, waterfalls, foam, and splashes resulting from interaction with solids. The goal of the player or autopilot is to drive a boat past as many checkpoints as possible while avoiding falling rocks and logs as well as deformable water plants.

A hybrid water-simulation method combines a height-field grid with particles. The main body of water is simulated by solving the shallow-water equations on the grid. Four types of particles are auto-generated using physically inspired criteria. Wave fronts with slopes exceeding a limit emit particles to form breaking waves. Waterfall particles are generated when the water flows across steep terrain. Collisions of solids with the water surface produce splashes with a volume that depends on the impact velocity. When particles fall into the grid, they are turned into foam which is then advected with the horizontal flow of the water surface. When particles are created, they take away mass from the grid and deposit it again when they return. The system adds water-surface details using wave textures generated by an FFT-based simulation. Texture coordinates are advected with the water flow and regenerated periodically to reduce distortion. Rigid and deformable objects are two-way coupled with the height-field simulation. Solids alter the height and velocity of water, which in turn exerts drag, lift, and buoyancy forces on the solids.

The underlying simulation technique is an extension of Chentanez N. and Muller M., Real-time simulation of large bodies of water with small scale details, Proceedings of the 2010 ACM SIGGRAPH/Eurographics SCA.