

RTFSS v1.1 RELEASE NOTES



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1 Resume

This release brings three major features to RTFSS fluids solver. With this iteration RTFSS can simulate a broader family of fluids enabling it to simulate viscoelastic fluids (experimental support though...). It also provides a solver for a simplified model of the Navier-Stokes eqs. for fluids namely the shallow water equations (wave equation). This method provides a very realistic mode of simulation which comes with all the techniques (some of it are state of the art in realtime applications using GPU for computations) that developers have in mind to achieve a very realistic demo of a pool. Namely:

- Reflections and raytraced (exact) refractions which blend accordingly to Fresnel equations
- Caustics.
- Positional 3D audio.

The first two provide the quality that can be achieved using a simple raytracer (with no color bleeding and caustics). The third one provides caustics effect which can be achieved using a raytracer with caustics. The last one enables 3D Audio(for seeing in its glory they must be used with 5.1 speakers).



2 Features

The most important features of this release are:

- Inclusion of a wave equation solver to simulate the shallow water equations. It uses by now and explicit method in time that although can be unstable for same dimensions of grid and other parameters of simulation brings hi-speed simulations (200x200 grids at +200fps on developers hardware.)
- Now RTFSS can simulate viscoelastic fluids (gels, toothpaste, blood, and other non-newtonian fluids. . . and in realtime of course :-). . .).

Based on the paper:

"A Method for Animating Viscoelastic Fluids." Goktekin, Bargteil and O'Brien, Siggraph 2004.

<http://www.cs.berkeley.edu/b-cam/Papers/Goktekin-2004-AMF/>

Load "viscoelastic.scn" for seeing it. Compare to a fluid loading "drop.scn" for seeing it.

For showing the first feature we have created our most spectacular demo (to date. . . :-)) which we call "pool demo" which features some novel techniques done in GPU (especially the last one) :

- Reflections and RAYTRACED REFRACTIONS (user can select between CPU mode and GPU mode for calculating it). On developers hardware, GPU refractions&reflections run at 1280x1024 at 120fps. CPU raytraced refractions run at 1280x1024 at 45-50fps.
- Enviromental 3D Audio using OpenAL library. And too a background sound. . . Only is showed when throwing drops with 'g' key. The engine supports standard OpenAL features at no cost like doppler effects and accurate physical model of sound attenuation. You can enable attenuation in scene file. Developers have tested on Audigy 2 cards and latest beta drivers from Creative web site which bring full OpenAL 1.0 hardware

acceleration to this soundcards and others (Audigy,Audigy2,Audigy4,X-Fi...) from this manufacturer. I have also included the latest redistributable OpenAL.dll wrappers and loaders (from Creative from [OpenAL SDK v1.1](#) not beta released 18 October 2005) wich bring OpenAL to all soundcards (via DirectSound or DirectSound3d wrappers)... It has been tested with 5.1 speakers and adding drops from different positions of camera and orientations and works!!... It has also been tested on Linux but only for surround channels (no lowfreq and no front center bass...)

It also can be an educational way of knowing of to mix OpenGL+OpenAL...

- Caustics on GPU!! (user can select to calculate in CPU) They are implemented by implementing a novel technique called "caustics mapping". It is a similar technique (in image space) to shadow mapping. For more info see:

Çaustics Mapping: An Image-space for Real-time Caustics."Musawir Shah,Sumanta Pattaniak, 2005.

<http://graphics.cs.ucf.edu/caustics/>

Note that the ray intersection is implimented by a not so general technique (but more fast...) as explained in this paper given that we only want to intesert a ray and a cube wich leads to simplifications. Paper says they have achieved for a "similar water configuration"(100x100 grid and 640x480 screen resolutions) 60fps. with a Geforce 6800 GT. We have achived near 70fps for a 200x200 grid and 1280x1024 screen resolutions but the quality perhaps is not as good as theirs...

- Mouse input for "animating water" with ALT+left mouse button and moving mouse you perturbate the pool and with 'g' key you add drops to the pool in random positions with positional sound. There is also an automatic perturbation of water but is disabled.

For running a demo with all this three eye-candy and ear-candy feautres run pool demo (the demo is activated by loading pooldemocaustic.scn).

Other features added:

- Multisample support and selection in scene file via a modified glut routine.
- Now you can grab screenshots via F1 keys (JPG format). They will be renamed for no overwriting.
- Ogg Vorbis sound format support via libvorbis library for drops and background sounds. It has been selected for three reasons:
 - for having good compression (some people say better than mp3 at same bitrate)
 - Open source format
 - Easy to learn and use librarys...
- Now you can select in scene files a lot of parameters. New solver parameters: like viscosity,free splip bc. or no-slip,solver mode=SHALLOW WATER,NAVIER STOKES,viscoelastic parameters. Sound parameters,fps for video grabbing, pool demo caustics,refractions,computation on gpu's,etc...)



- Installer adds a link to source code root dir and documentation file.

Bug fixes

3

- Included all DLL libraries needed to run... Sorry for not fixing before...
- Now works with Intel MKL 8.0 final version.
- Now works ok with .dds files with no mipmaps (specially cubemaps).
- Memory fix: Now don't allocates an stencil buffer if shadows aren't enabled.
- The DDS loader was ok but I loaded textures with "LINEAR MIPMAP LINEAR" texture parameter.
- SOR iteration mode now works... (I called a function with broken name...)
- Now .OBJ,.MTL and scene loaders don't crash if there isn't a final blank line.
- Minor fixes in CPU detection module for compatibility with WINE (detected 0 Cpu's).
- and many more...