Real-time visualization of ship and wavy surface motions based on GPGPU computations

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Virtual testbed project

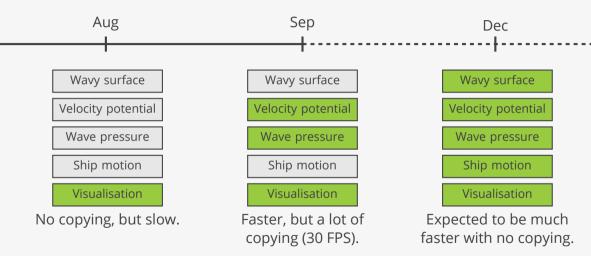
Global goal: Decision support system that analyses data from ships in sea, models the environment and predicts (and prevents) dangerous situations.

Current goal: Real-time simulation environment for ships with visualisation.

Key features:

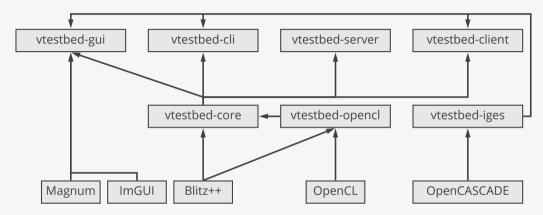
- ► Real-time. We have 16–33 ms to compute everything.
- ► Realistic marine objects. We load ships from IGES files.
- ► Arbitrary-amplitude ocean waves (work-in-progress).

Project timeline (2018)





On the shoulders of giants



- ► Takuya Ooura. "General Purpose FFT Package." Kyoto University (2006).
- V. Volkov, B. Kazian. "Fitting FFT onto the G80 architecture." University of California, Berkeley (2008).

Zero copy

Q: How to synchronise ship position and orientation between OpenCL and OpenGL without copying to RAM?

A: Use OpenCL/OpenGL interoperability (*cl_khr_gl_sharing* extension).

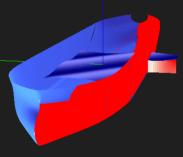
- ► Create OpenCL buffer from OpenGL buffer.
- ► Lock the buffer with *clEnqueueAcquireGLObjects*.
- ► Update the buffer.
- ► Unlock the buffer with *clEnqueueReleaseGLObjects*.
- ► Draw the buffer.
- ► Wait for completion with *glFinish*.

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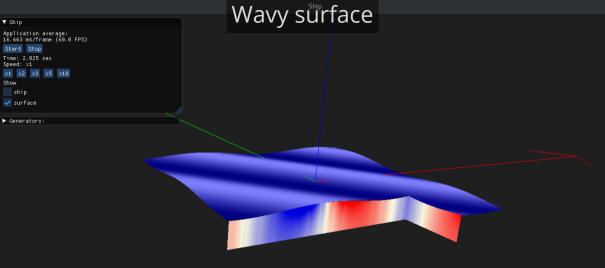
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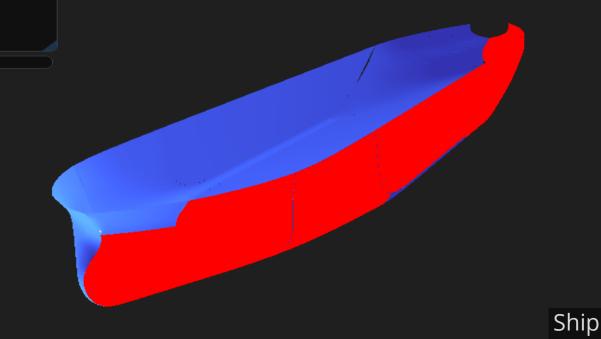




Visualisation



Velocity potential field slice



▼ Ship

Application average: 16.667 ms/frame (60.0 FPS) Start Stop Time: 0.000 sec Speed: x1 x1 x2 x3 x5 x10 Show

ship

GUI

🗸 surface

▼ Generators:				
▼ Plain wave surface generator				
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