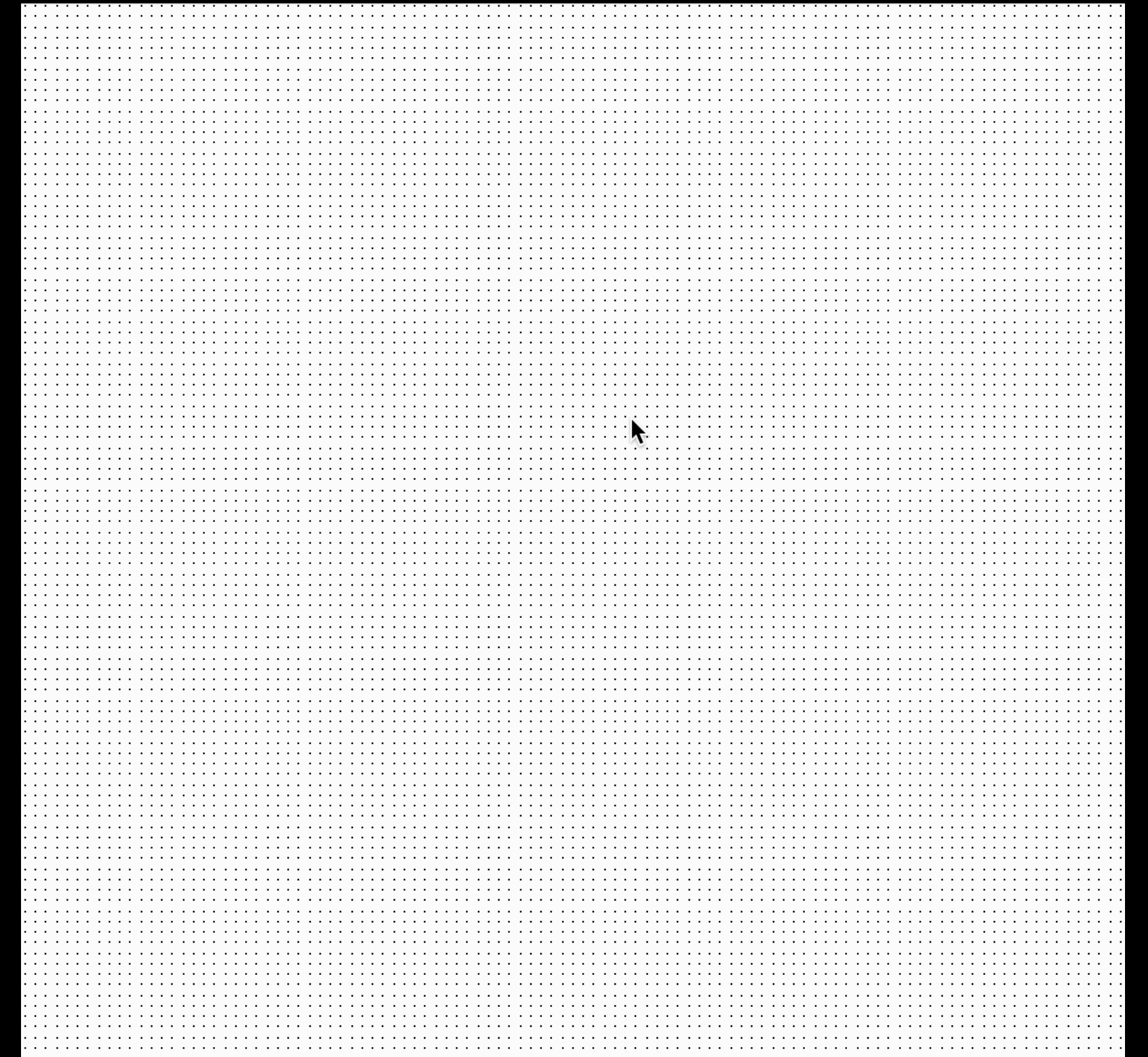


2D Stable Fluids

Game Physics 22/23 Final Project



Our result (Density field visualiser)

Gianmarco Picarella (2713810) & Francesco Cardarelli (1873024) - 13/04/2023

Overview

**2D Stable solver implementation based on
Jos Stam's “Real-Time Fluid Dynamics for
Games” paper**

Main features

Key points

- Coded from scratch though some of our functions are based on Jos Stam's paper implementations
- Stable fluid simulation on a 128x128 grid
- 2D visualisation based on two modes: velocity and density field
- Upscaling from the “real” 128x128 simulation grid to the 800x800 pixels window
- The user can add a dye to the fluid at will
- The user can apply a force and see the velocity field reacting to it
- The user can manipulate the diffusion, viscosity and vorticity in real-time through a dedicated GUI
- The user can pause or reset the simulation at will

Physics Concepts

Key points

- Semi-lagrangian simulation
- Navier-Stokes equations (Topic 10 slide 5)
- Fluid incompressibility (Topic 8 slide 5, Topic 10 slide 18)
- Fluid velocity and density fields (Topic 8 slide 2, 3)
- Boundary conditions (Topic 8 slide 13, Topic 10 slide 21)
- Diffusion, advection, projection and vorticity confinement (Partially discussed in topic 8, Topic 10 slide 7)

Framework used

Key points

- C++ 14 as programming language (typically much more efficient)
- CMake for the building process
- GLUT and OpenGL 2 for 2D rendering and visualisation purposes
- Dear ImGui as graphical user interface

Thanks for your attention!