IMPLICIT CUT-CELLS IMPLEMENTATION FOR SUB-GRID LIQUIDS SIMULATION

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PREVIOUS WORK ON LIQUIDS SIMULATION

Cut-cells in Liquids Animation

Simulated on coarse grid

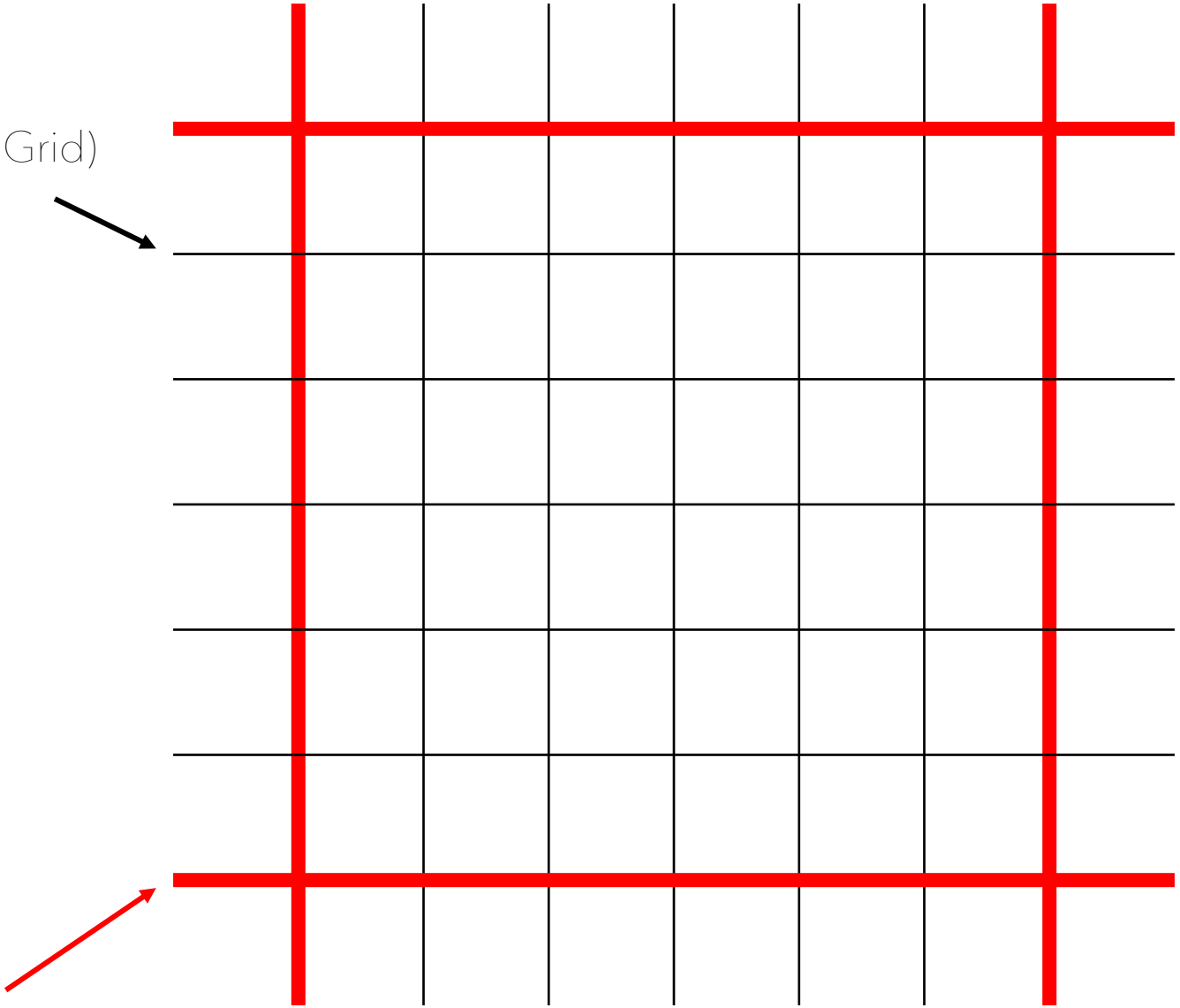
High resolution mesh

Icons by *Good Ware* & *Smashicons* (flaticon.com)

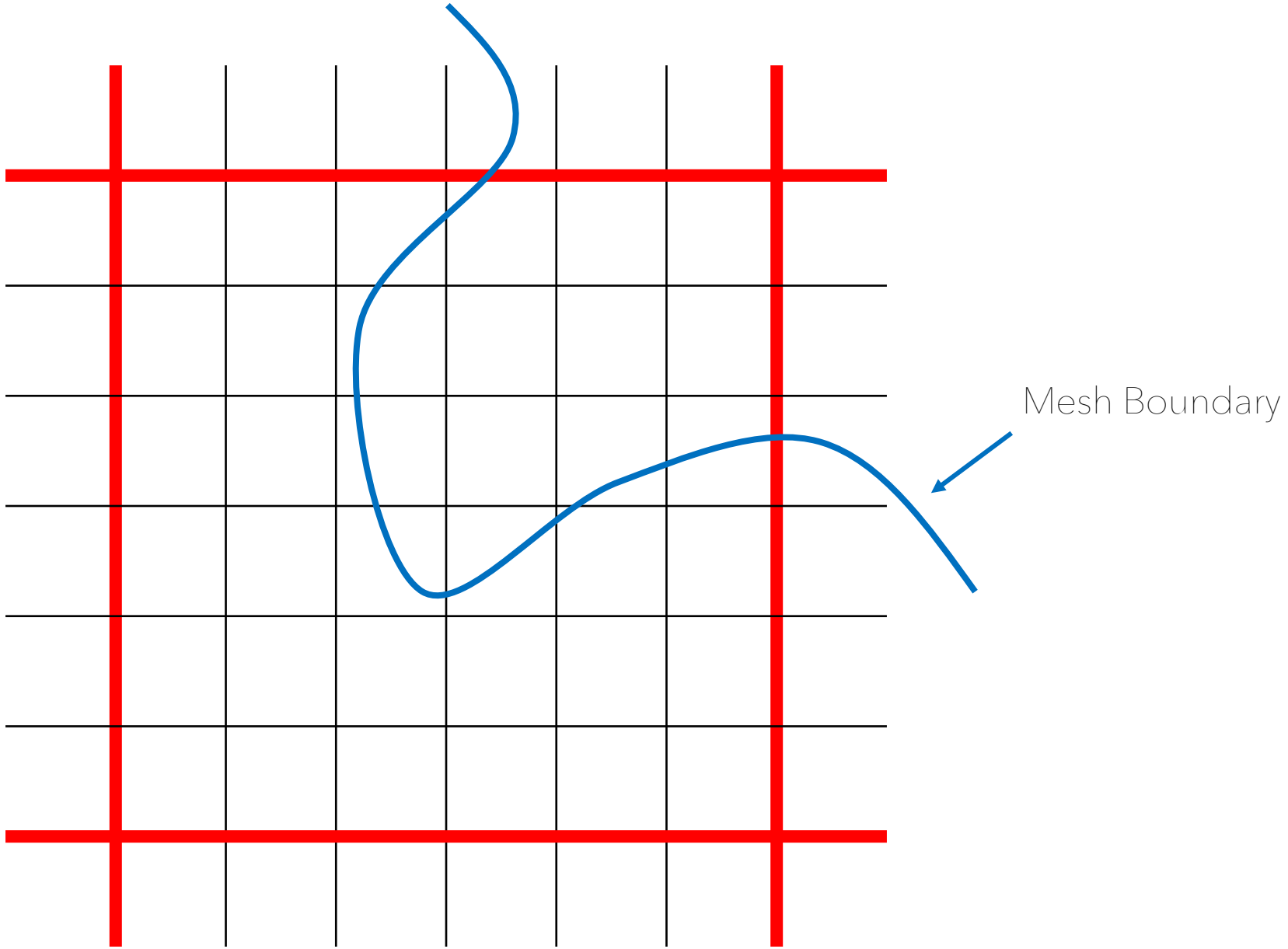
Cut-cells in Liquids Animation

Moana, Disney 2016

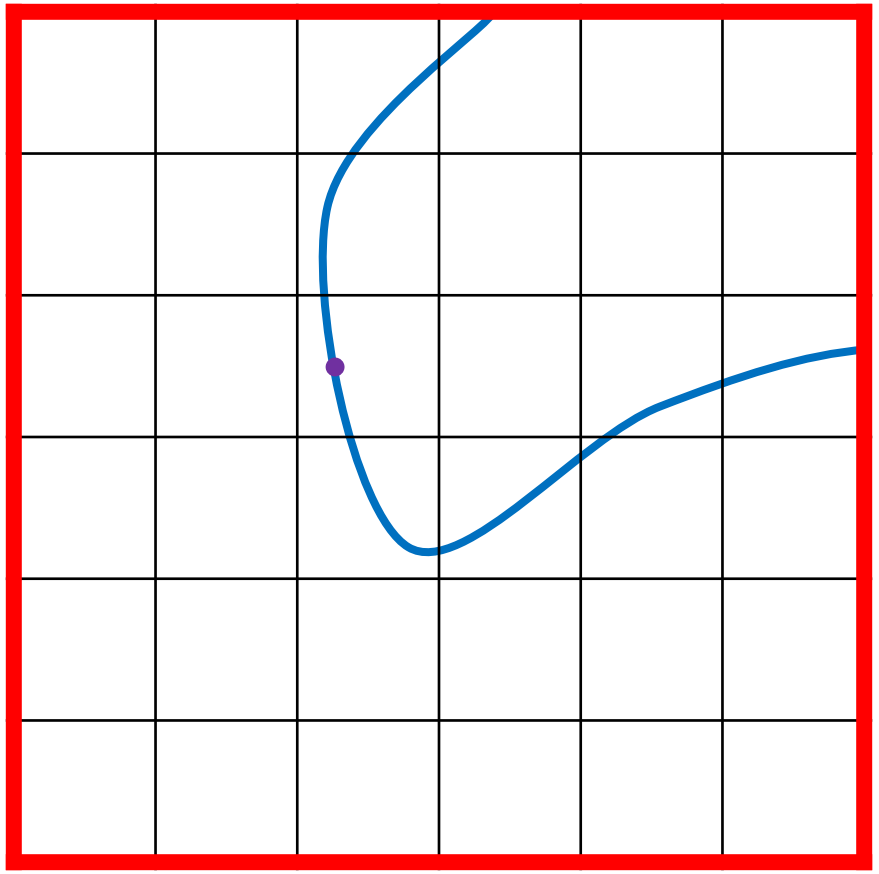
Fine Grid (Level Set Grid)



Coarse Grid (Simulation Grid)


Mesh Boundary

Ghost Fluid Method : current state of the art method



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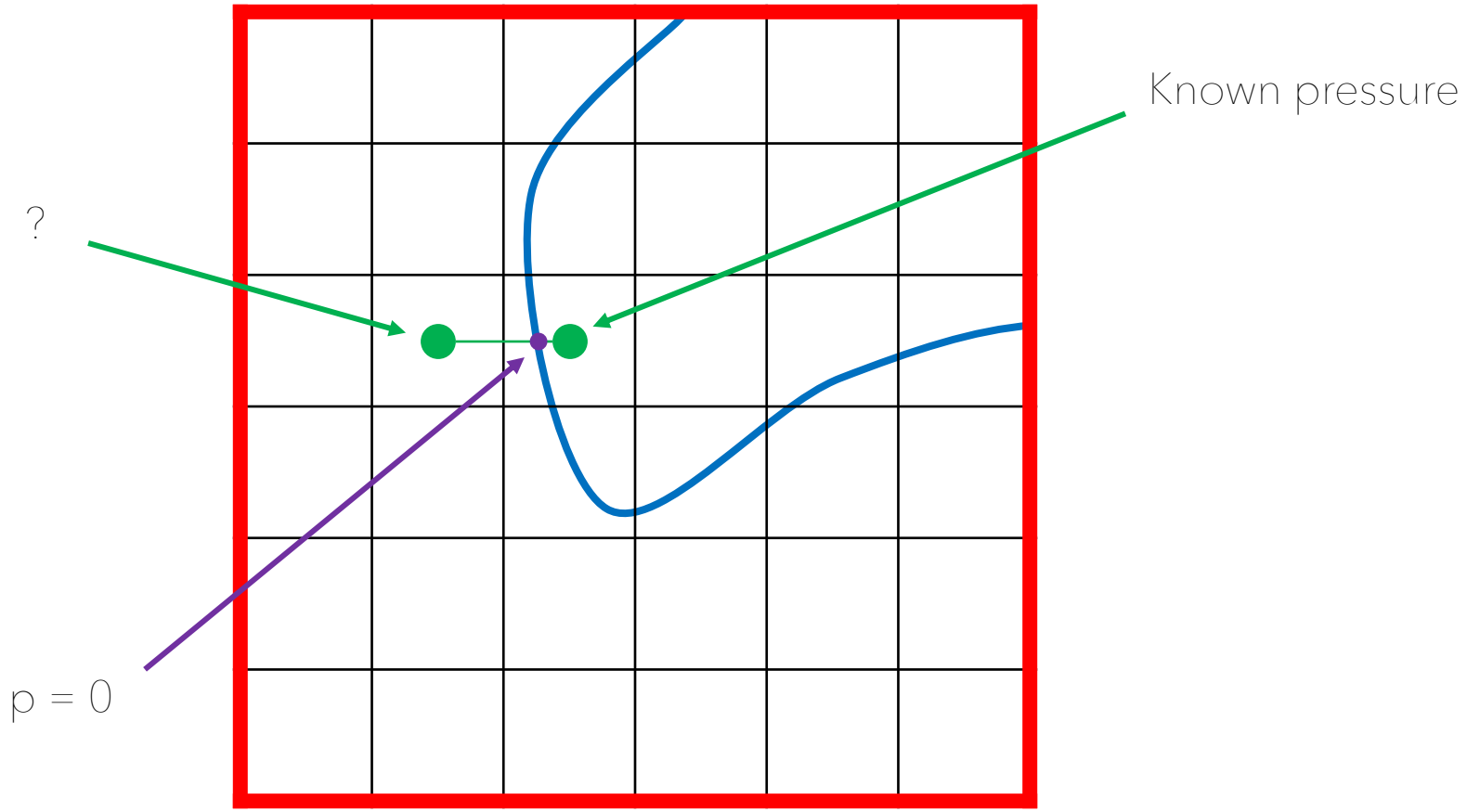
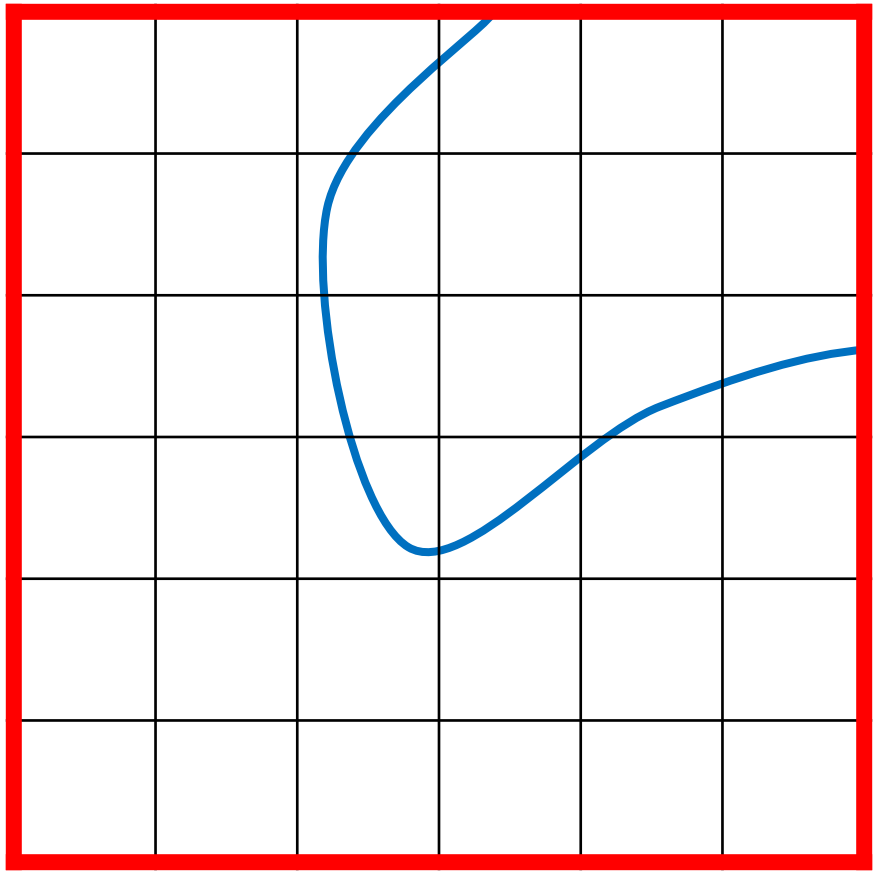


Current Cut-cell Method : edge intersection and vertex creation



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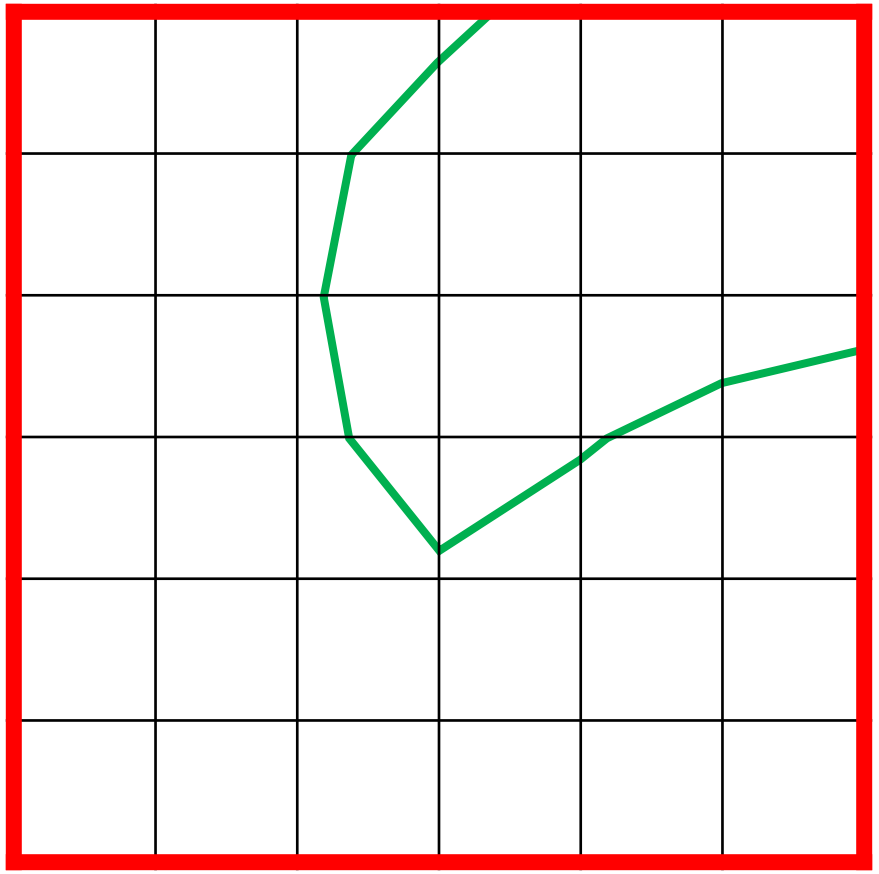
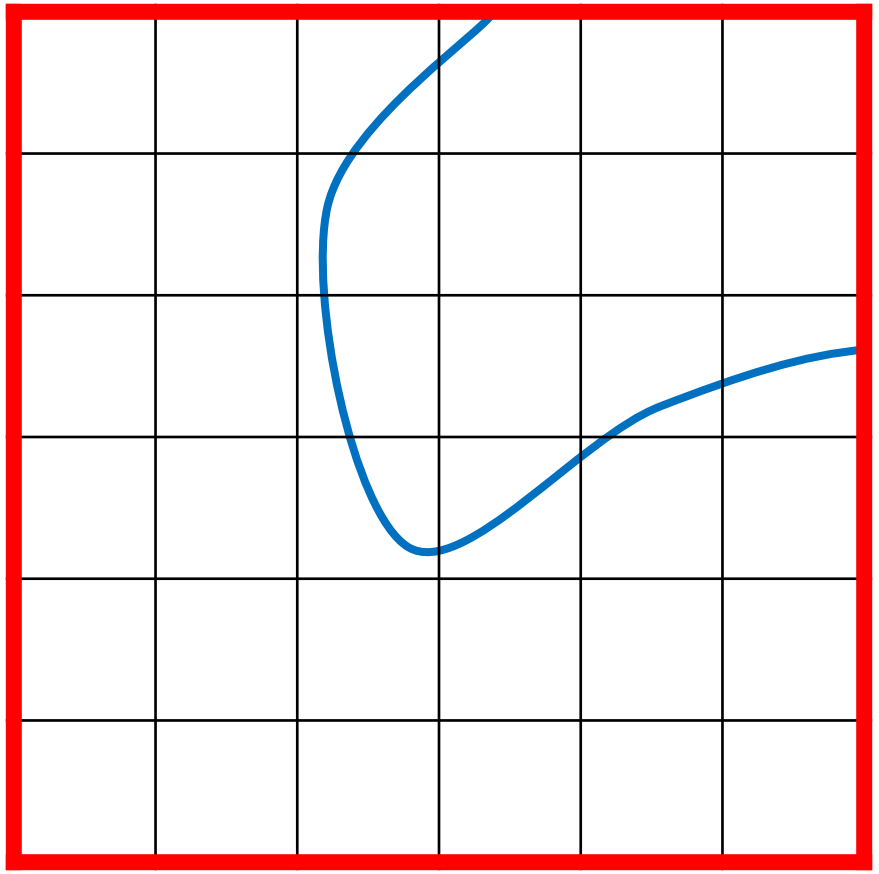


Implicit Cut-cell Method : connectivity tracking



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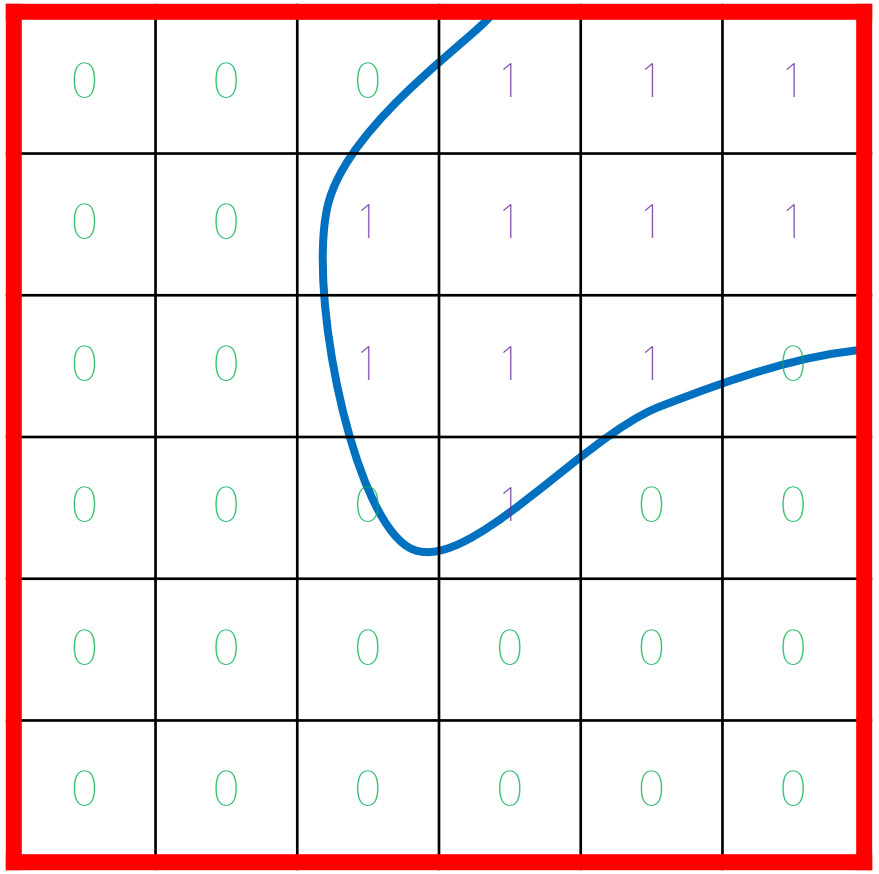

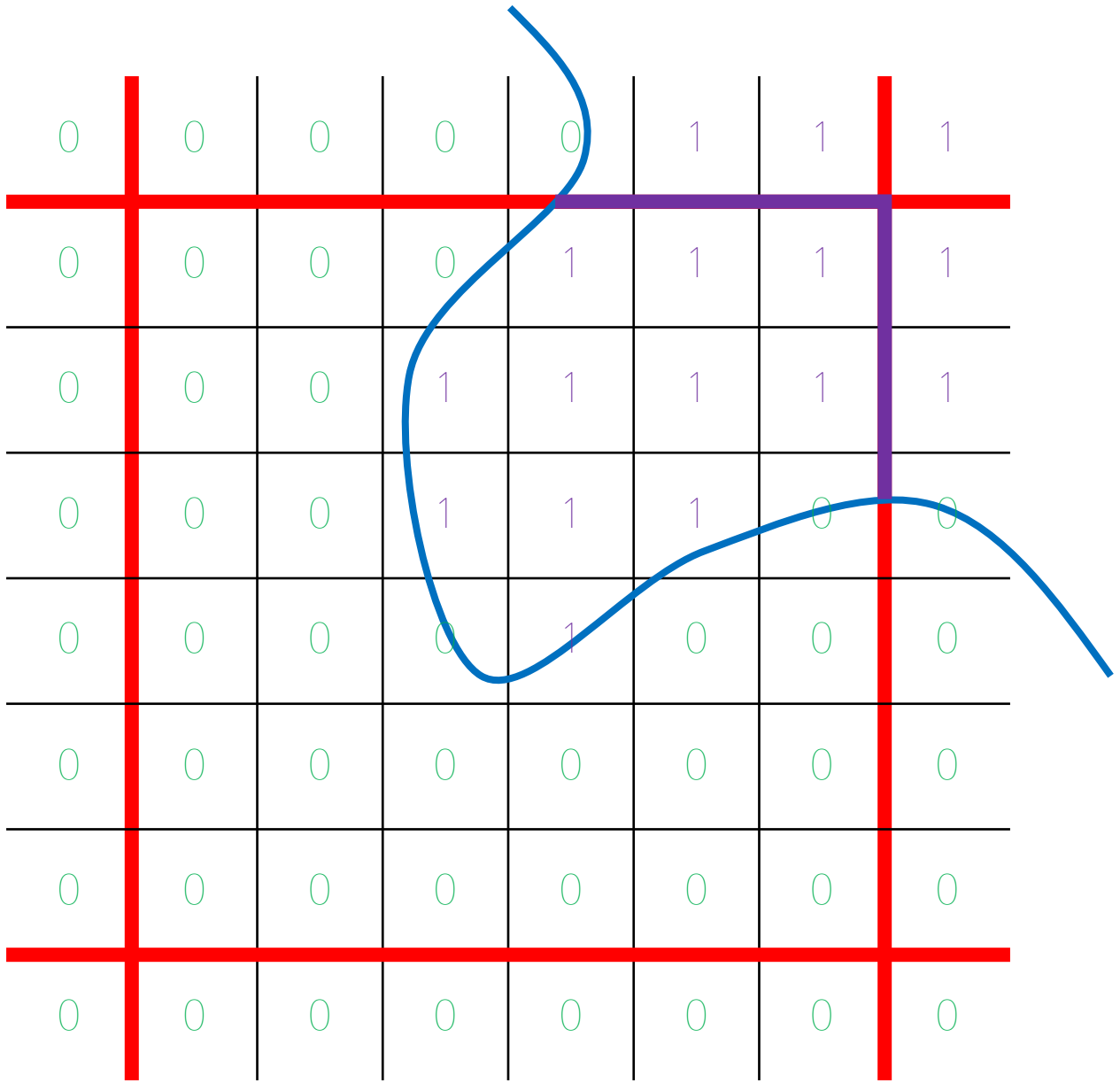
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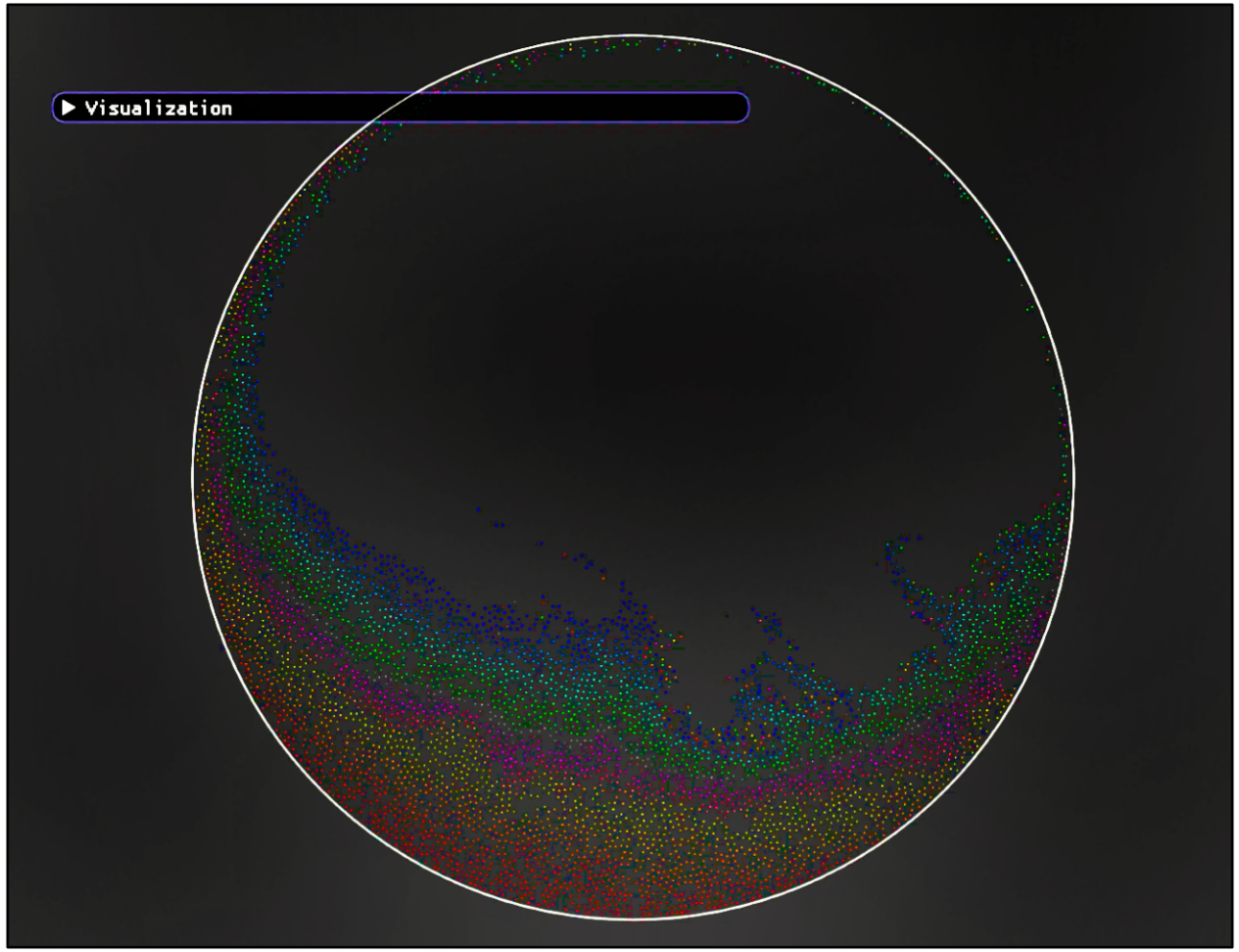
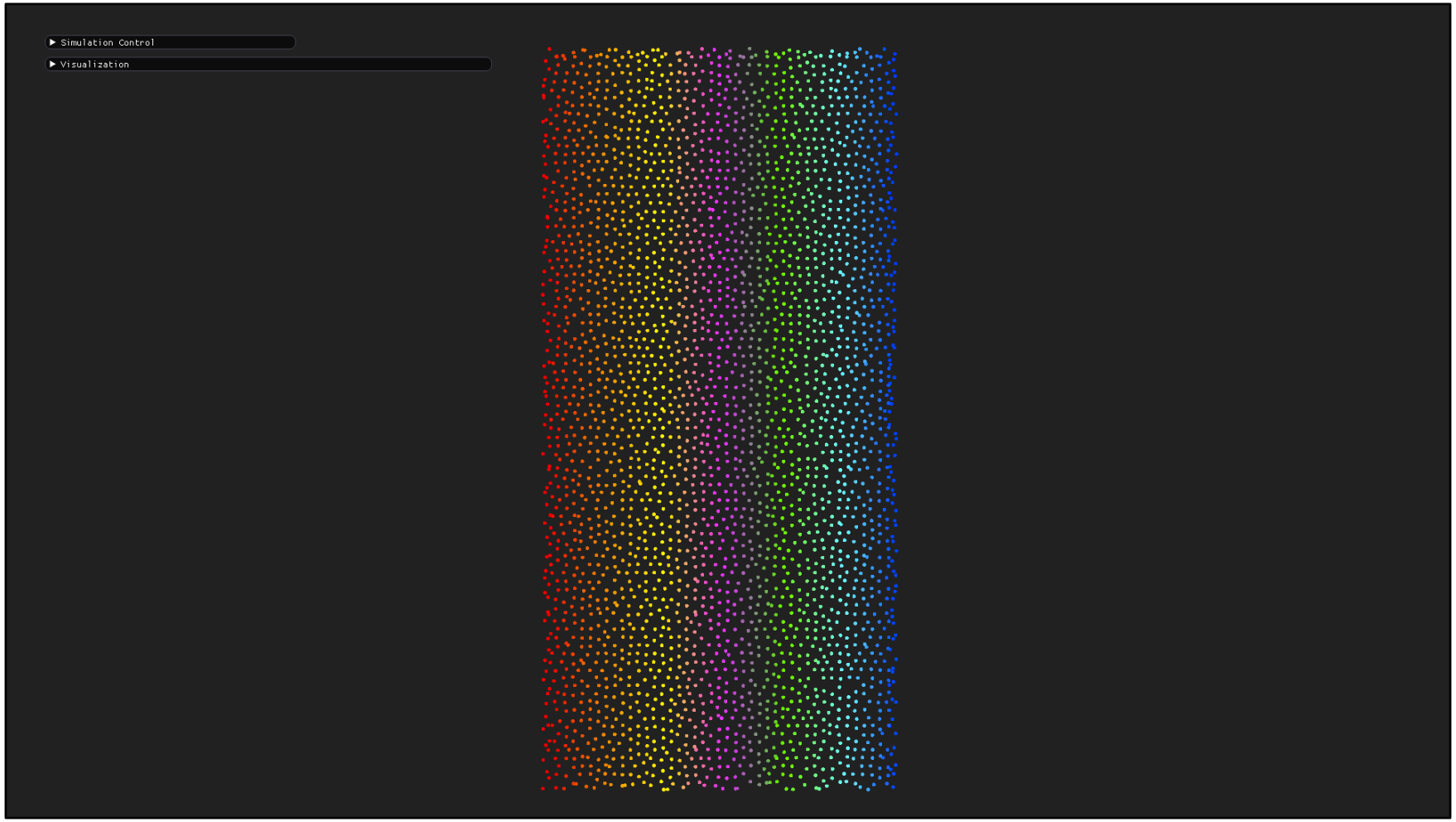
0 0 0 0 0 0 0 0

CORE OF THE THESIS

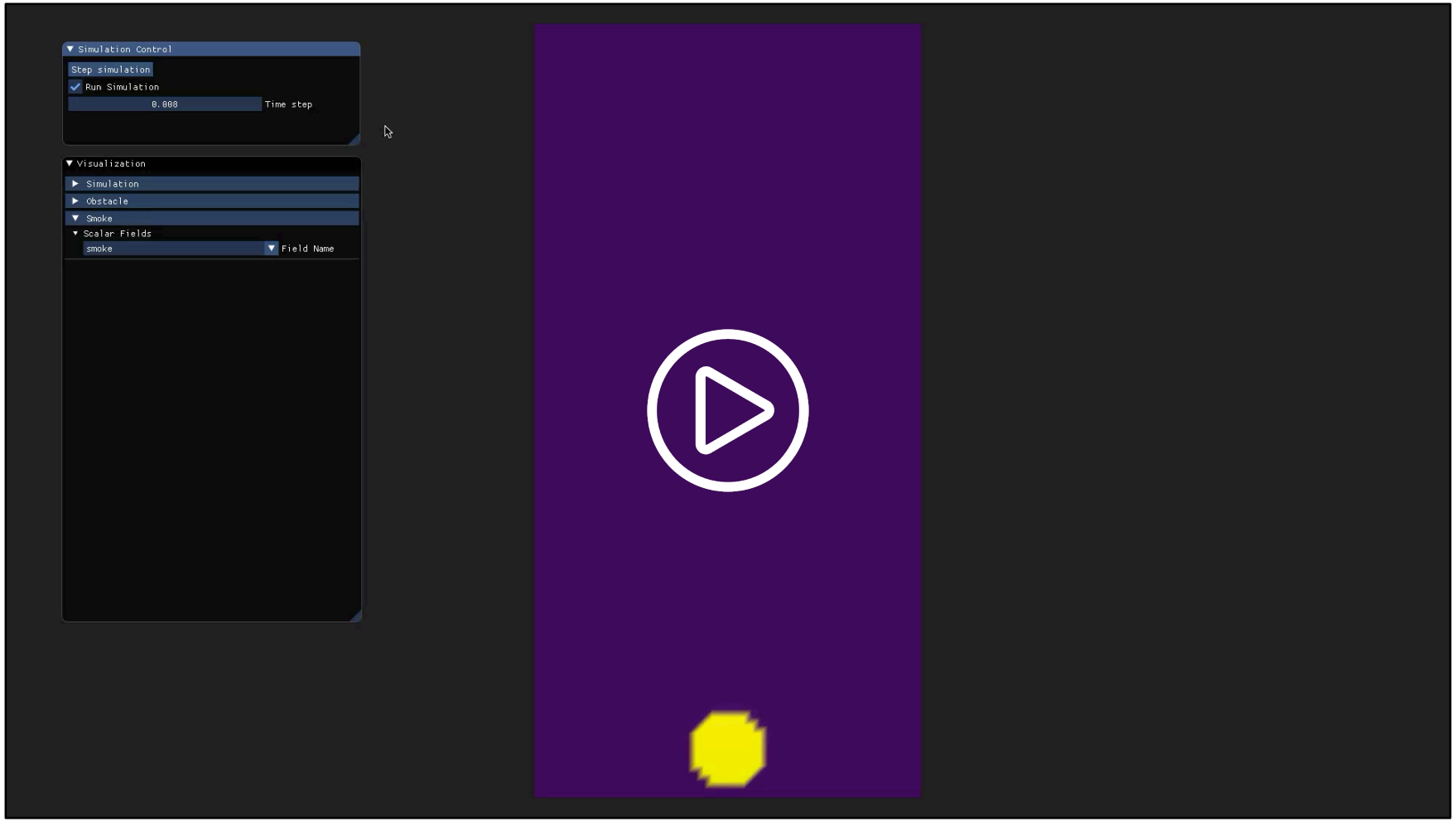
Flow Solver Setup : rendering

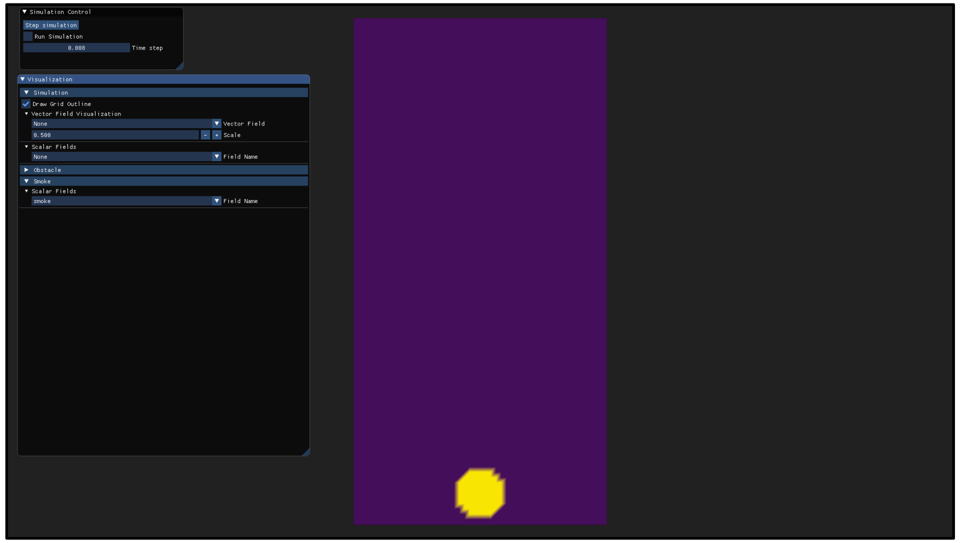


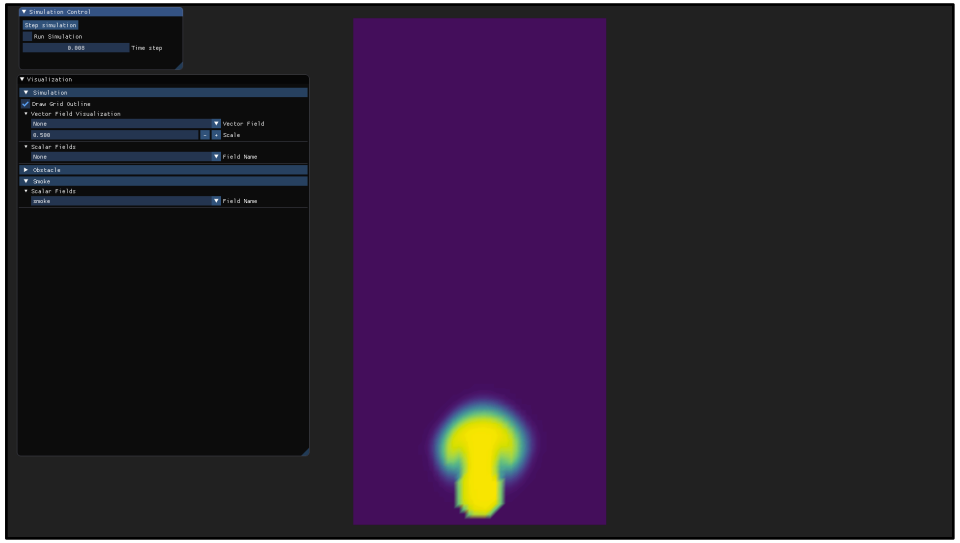
Flow Solver Setup : rendering



Flow Solver Setup : voxelized grid solver




Simulation Control
Step simulation
Run Simulation
0.008
Time step
Visualization
Simulation
Draw Grid Outline
Vector Field Visualization
None
Vector Field
0.500
Scale
Scalar Fields
None
Field Name
Obstacle
Smoke
Scalar Fields
smoke
Field Name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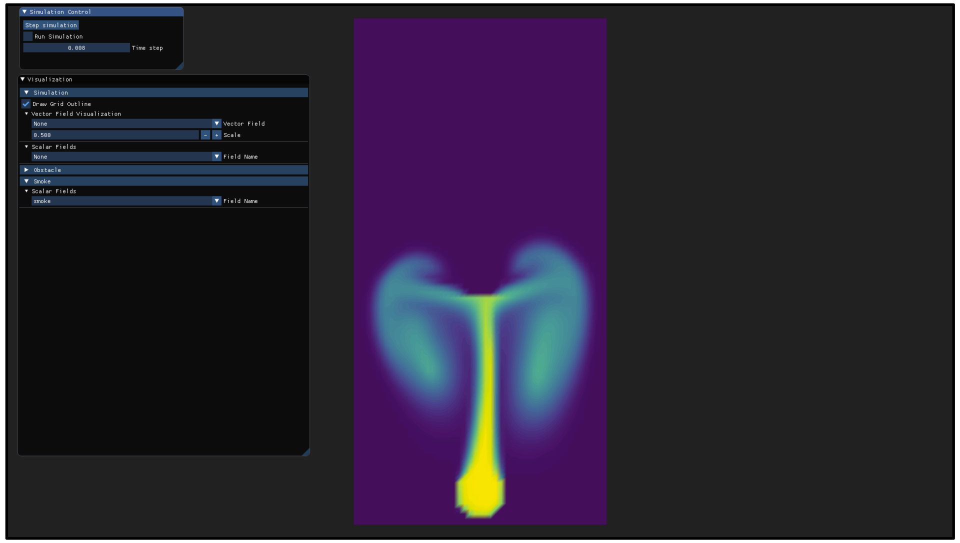
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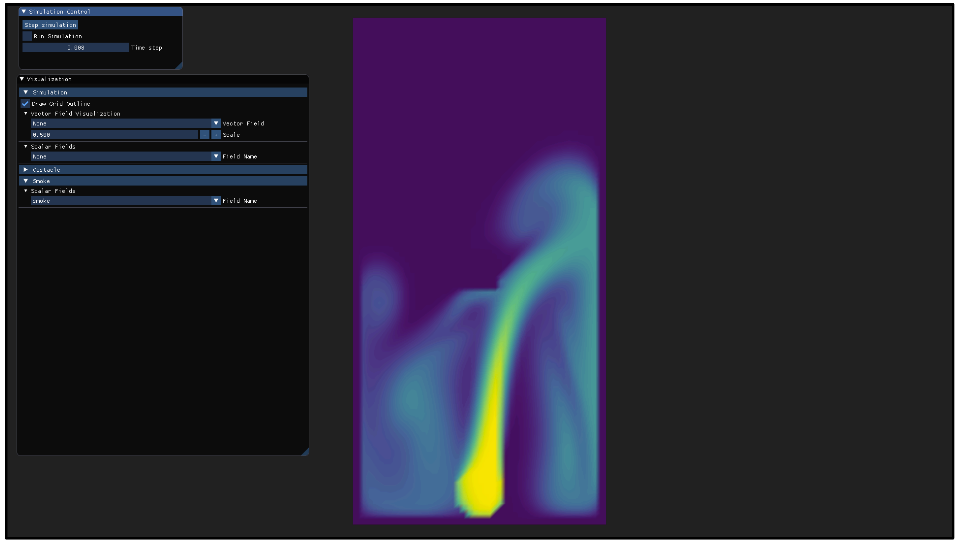
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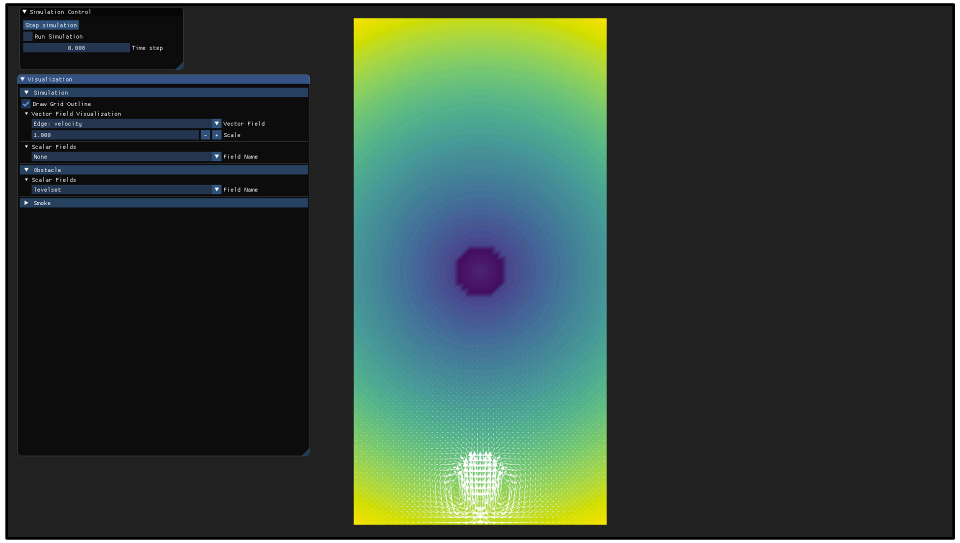
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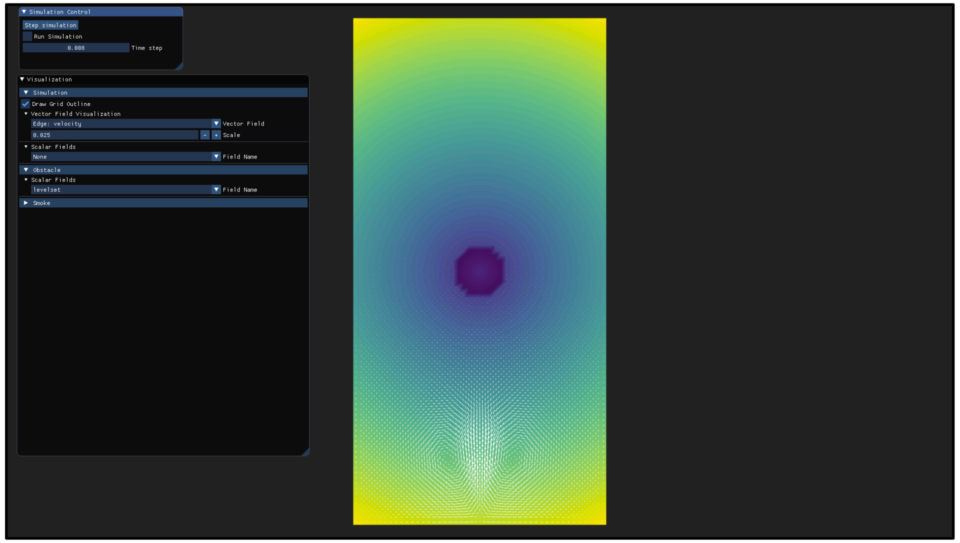
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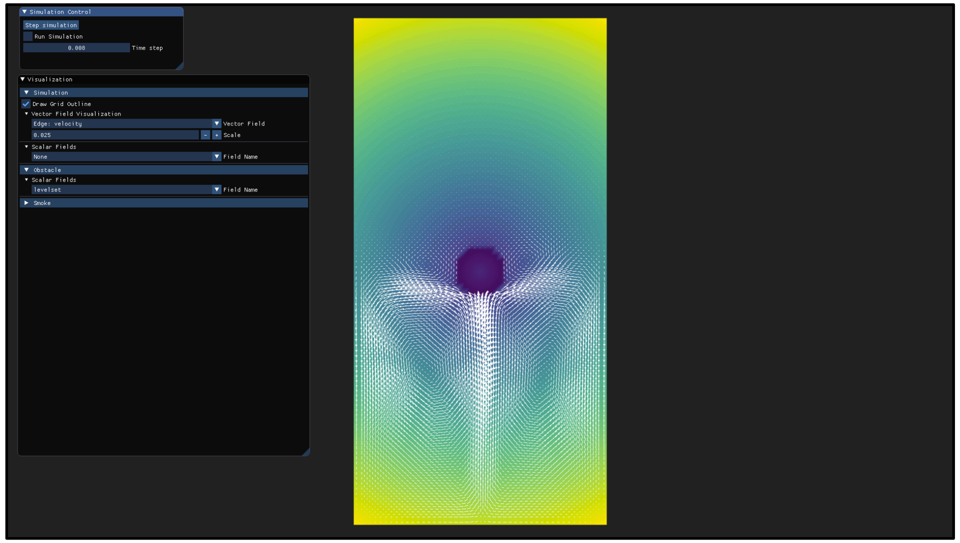
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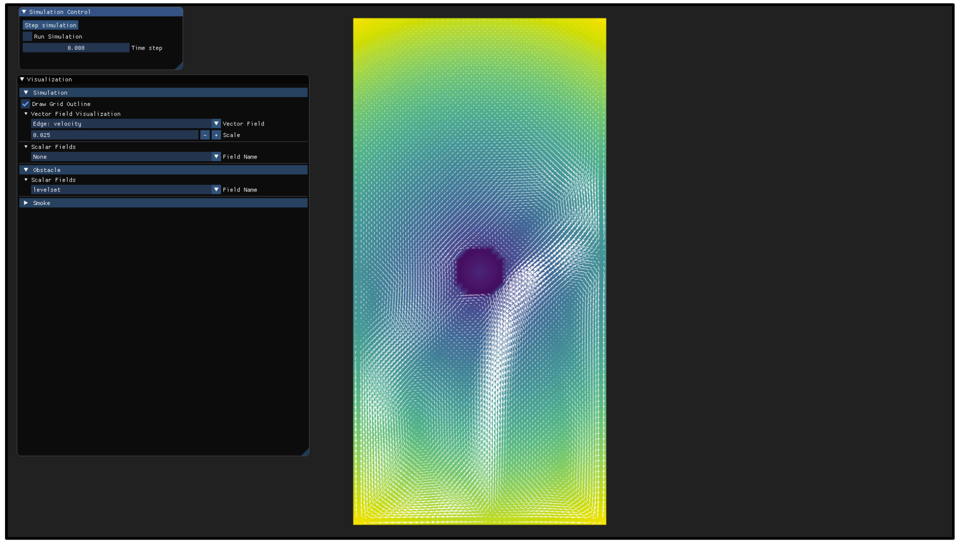
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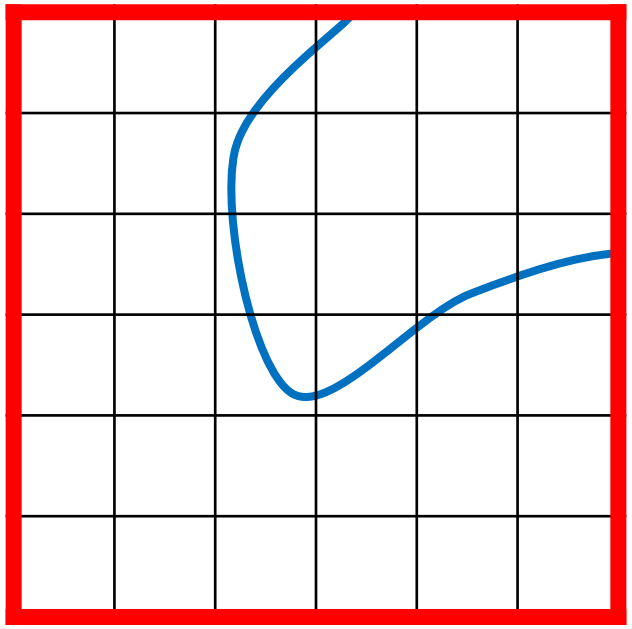
Implementation Challenges

- Compiling Chimera on clang
- Temporary particles in the GridRenderer class
- Particle dragging issue
- Invisible simulation grid (only on MacOS)

Implicit Cut-cell Method : algorithm



For each SimulationGrid cell, we do :

¬ Iterate over LevelSetGrid border vertices

¬ If change of level-set attribute sign

¬ Compute fraction

¬ Iterate until MarchingSquaresOneStep vertex out of current SimulationGrid cell

¬ Continue along border LevelSetGrid vertices until we arrive at starting vertex

¬ If we traversed less than *(4x SimulationGrid edge length) – 4 vertices*

¬ Jump to vertex succeeding first MarchingSquaresOneStep vertex and start over

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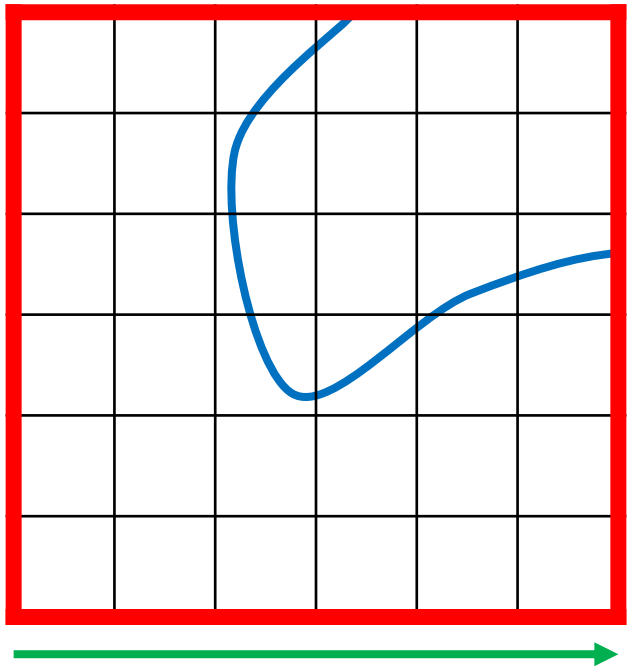

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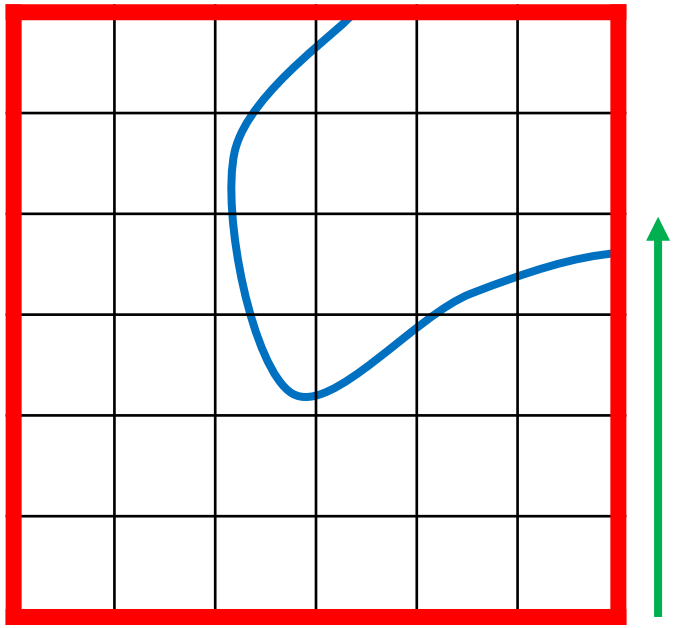

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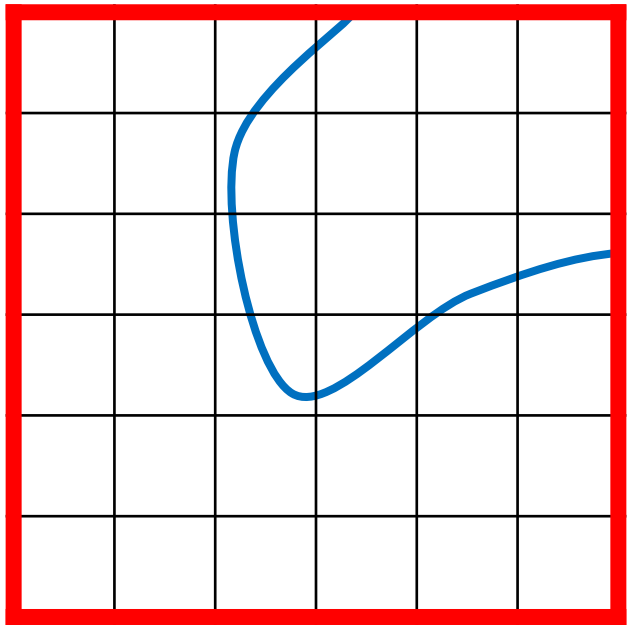

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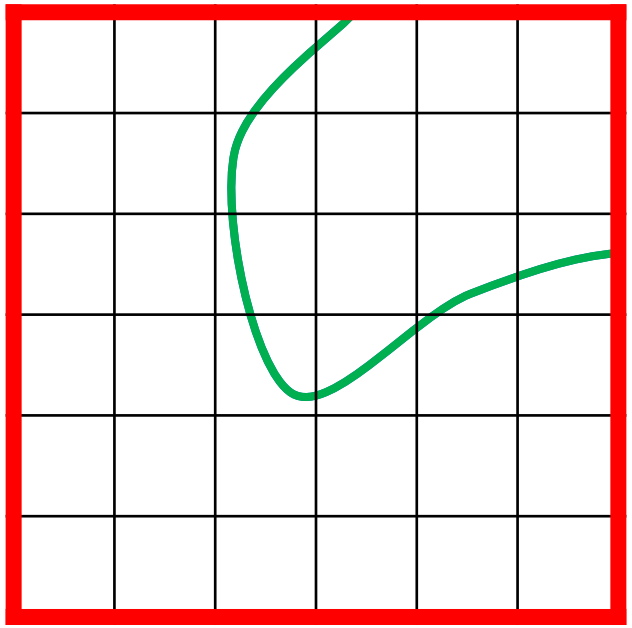

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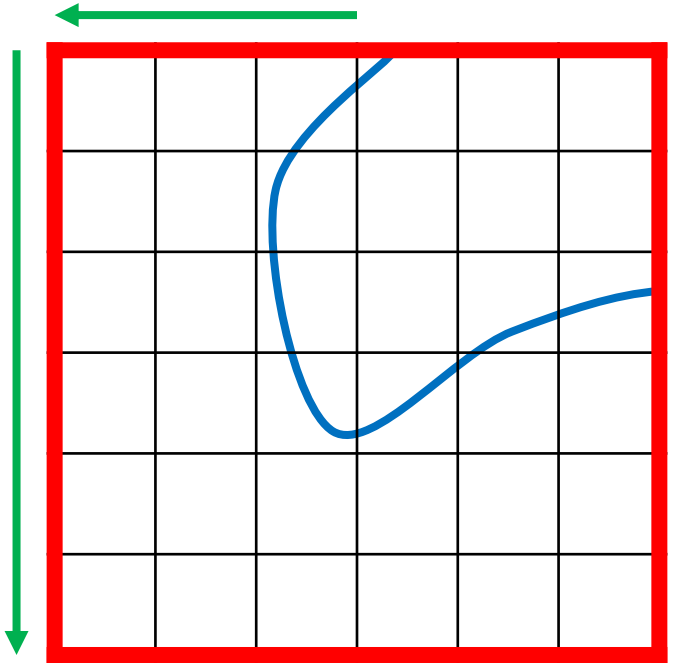

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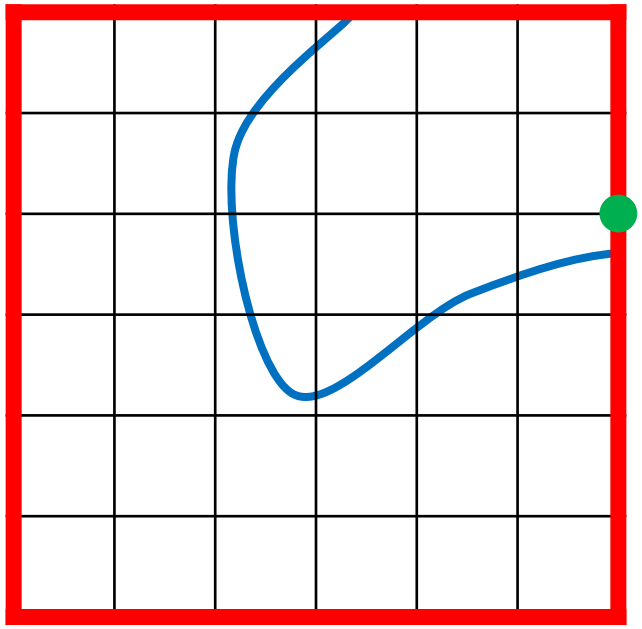

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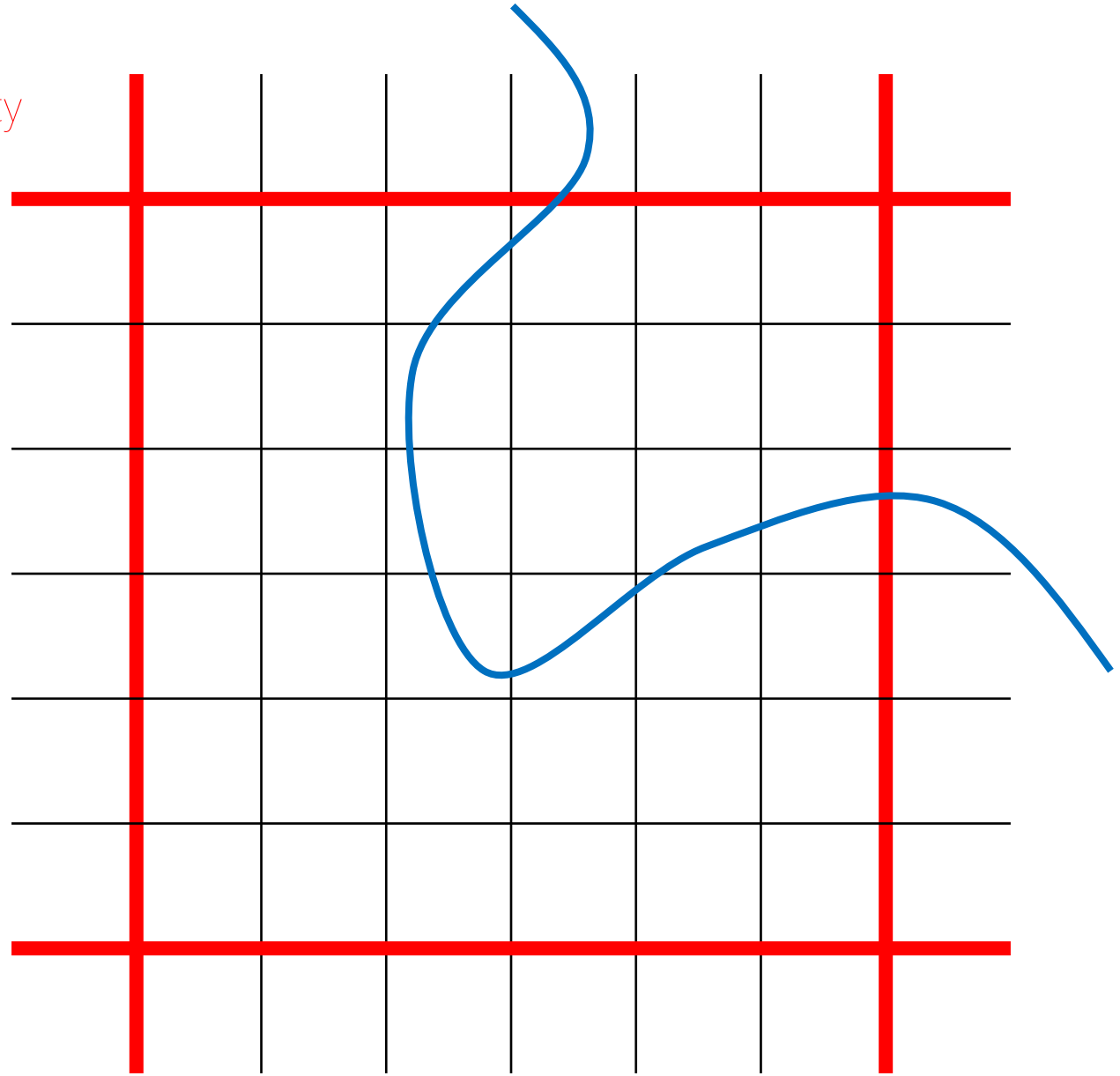
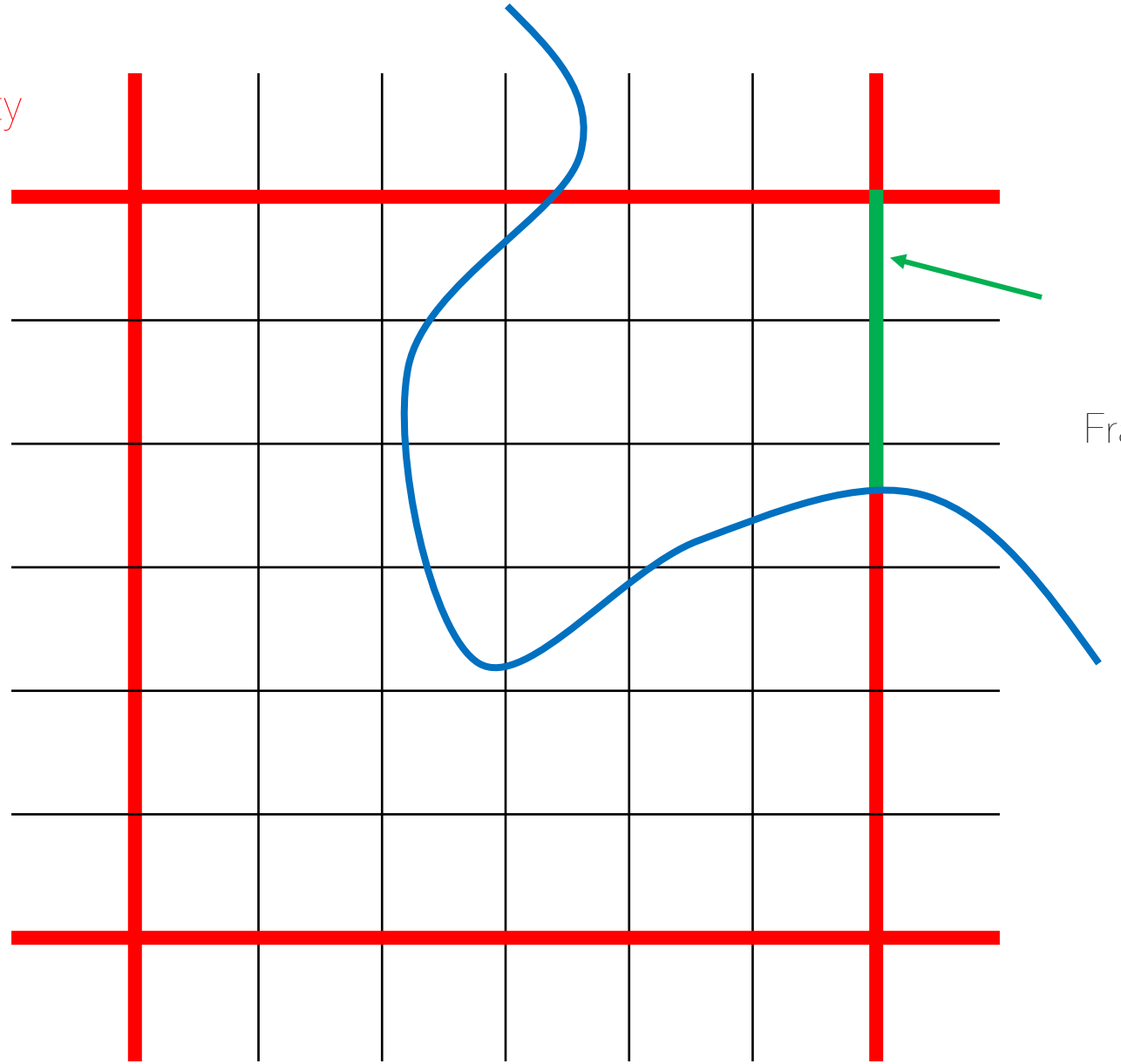
Storing the connectivity

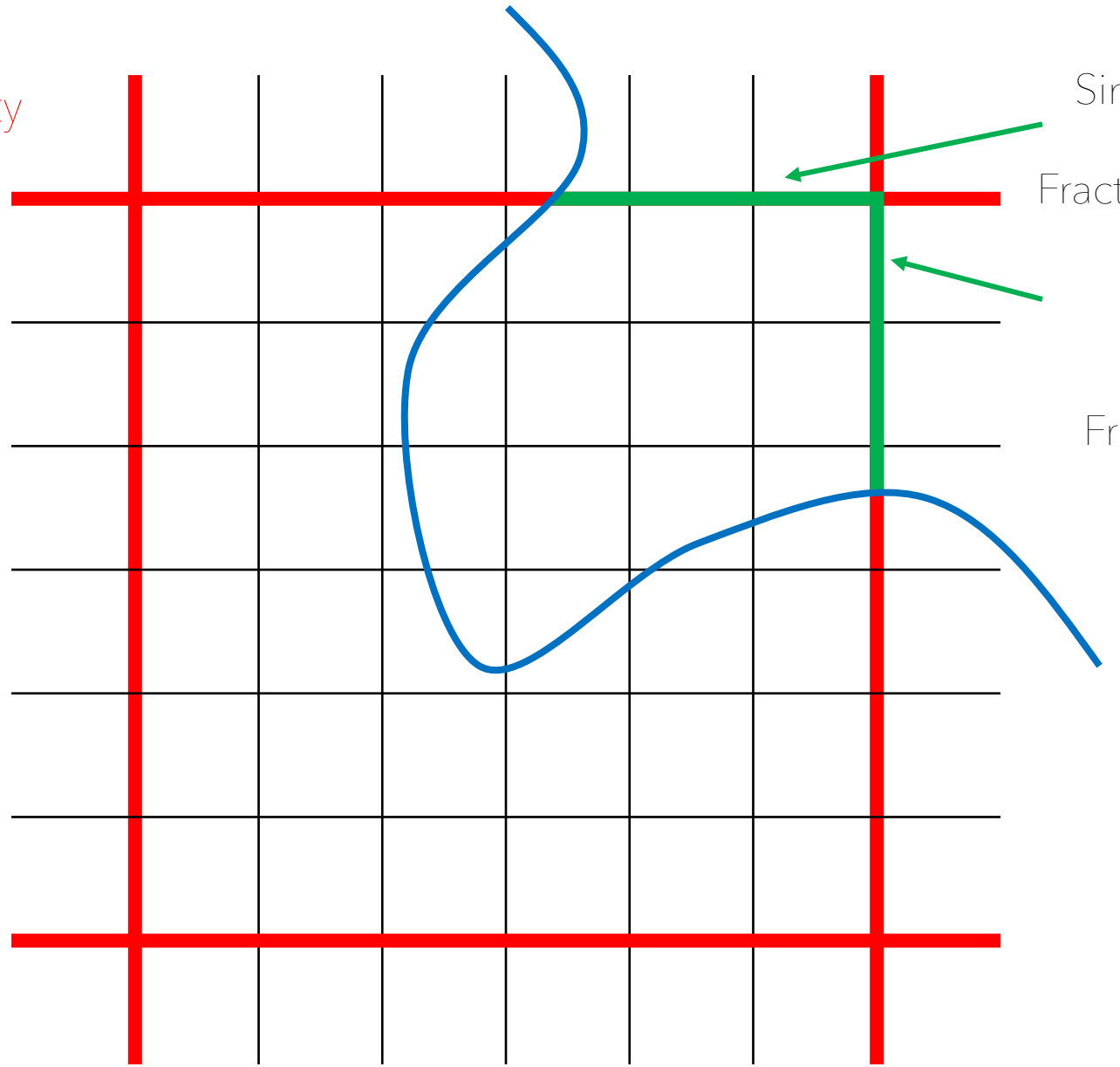


Storing the connectivity



SimulationGrid Cell 1
Right edge
Fraction 2 with length 3/7

Storing the connectivity



SimulationGrid Cell 1
Top edge
Fraction 1 with length 3/7

SimulationGrid Cell 1
Right edge
Fraction 2 with length 3/7

THANK YOU