TamiFlu

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What is TamiFlu?

- 2D Fluid Simulation Framework
  - Written in C# / .NET 4.7.1
  - Focus on Exchangeability

- Prerequisites
  - C# Compiler, e.g. Microsoft Visual Studio 2017
    https://www.visualstudio.com
Fluid particles: 3400
Boundary particles: 280
Time: 0.204700 s
Time step: 0.00047156489 s
PDE solver converged 74x
PPE iterations: 9
Error: 1.113054 %

Computation time for advection: 0.0726 ms
Computation time for simulation: 21.0909 ms
Computation time for searching neighbors: 0.2697 ms
Indicators: 0.1833 ms
Sorting and reordering particles: 0.6466 ms
Build grid: 4.3073 ms
Query grid: 1.0753 ms
Computation time for volumes: 0.4263 ms
Computation time for external accelerations: 0.6509 ms
Computation time for calling the IFP: 14.8072 ms.
Simple SPH Fluid Solver

for all particle $i$ do
  find neighbors $j$
for all particle $i$ do
  $\rho_i = \sum_j m_j W_{ij}$
  compute $\rho_i$ from $\rho_i$
for all particle $i$ do
  $a_i^{\text{pressure}} = -\frac{1}{\rho_i} \nabla p_i$
  $a_i^{\text{viscosity}} = \nu \nabla^2 v_i$
  $a_i^{\text{other}} = g$
  $a_i(t) = a_i^{\text{pressure}} + a_i^{\text{viscosity}} + a_i^{\text{other}}$
for all particle $i$ do
  $v_i(t + \Delta t) = v_i(t) + \Delta t a_i(t)$
  $x_i(t + \Delta t) = x_i(t) + \Delta t v_i(t + \Delta t)$
Simple SPH Fluid Solver with TamiFlu

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  $a_{i,\text{other}} = g$
  $a_i(t) = a_{i,\text{pressure}} + a_{i,\text{viscosity}} + a_{i,\text{other}}$

for all particle $i$ do
  $v_i(t+\Delta t) = v_i(t) + \Delta t a_i(t)$
  $x_i(t+\Delta t) = x_i(t) + \Delta t v_i(t+\Delta t)$
for all particle $i$ do
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for all particle $i$ do
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    $a_i(t) = a_{i, \text{pressure}} + a_{i, \text{viscosity}} + a_{i, \text{other}}$

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IParticleNeighborhood.SearchNeighbors()

Advection

Compute Density

IStateEquation.ComputePressure()

IPressureForce.ApplyToFluidParticles()
IViscousForce.ApplyToFluidParticles()
IExternalForce.ApplyToFluidParticles()
Interfaces in TamiFlu

- IParticleContext
- IFluidSolver
- IExternalForce, IPressureForce, IViscousForce, ISurfaceTensionForce
- IKernel
- IStateEquation
- IParticleNeighborhood, INeighborSet
- ITimeStep
- ...

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- Demo