Spatiotemporal Modeling and Simulation

10 :: Flow
**Topic**

Flow

**Program**

Governing equations for flow
Flow simulations using particles
Algorithm
Characteristics
Self-test questions
Learning goals

Have seen the governing equations for flow
Know what incompressibility means and how it simplifies the governing equations
Know by heart how circulation induces velocity
Be able to implement a hybrid particle-mesh flow simulation
Know the advantages and disadvantages of it compared to grid-based methods
Incompressible Vortex Method with PPM

Short-wave Instability of Asymmetric Trailing Vortices

Author: Michael Bergdorf
Advisor: Petros Koumoutsakos

Computed using a parallel 3D hybrid vortex method
Incompressible Vortex Method with PPM

**PPM showcase**

**Mixing of a Passive Scalar in a Periodic Double Shear Layer**

- Grid: 257 x 129 x 257
- Re = 990
- Sc = 2
- Initial condition: Double shear layer perturbed with the lowest mode using a PPM-based VIC code

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Incompressible Vortex Method with PPM

Quasi-Collision of Two Vortex Rings

Grid: 129 x 129 x 129
Re = <unknown>
Sc = 2
Initial condition: Two vortex rings of different radius perturbed with the lowest mode using a PPM-based VIC code
Incompressible Vortex Method with PPM