Seminar - Graphische Datenverarbeitung

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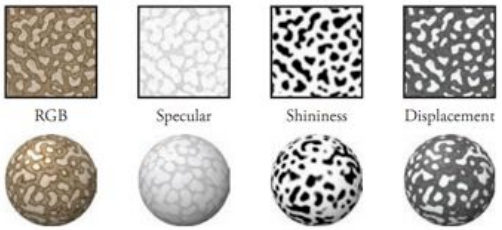
Topic Overview

Several topics in the following categories

- Variational Integration
- 3D Texture Synthesis
- Fluid Mechanics
- Medical Dataprocessing
- ...

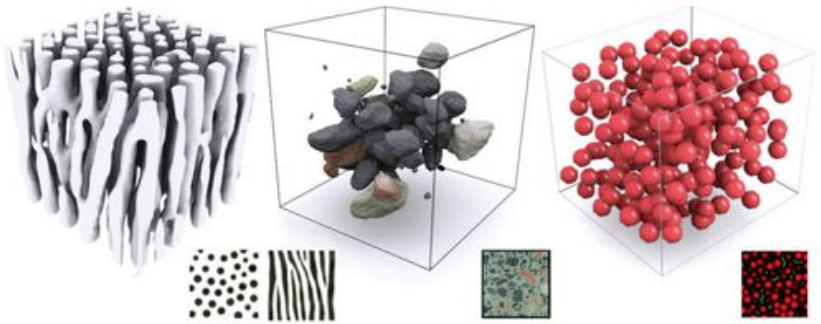
The following slides show a short overview of available topics.



3D Texture synthesis

using

2D Textures



Motivation

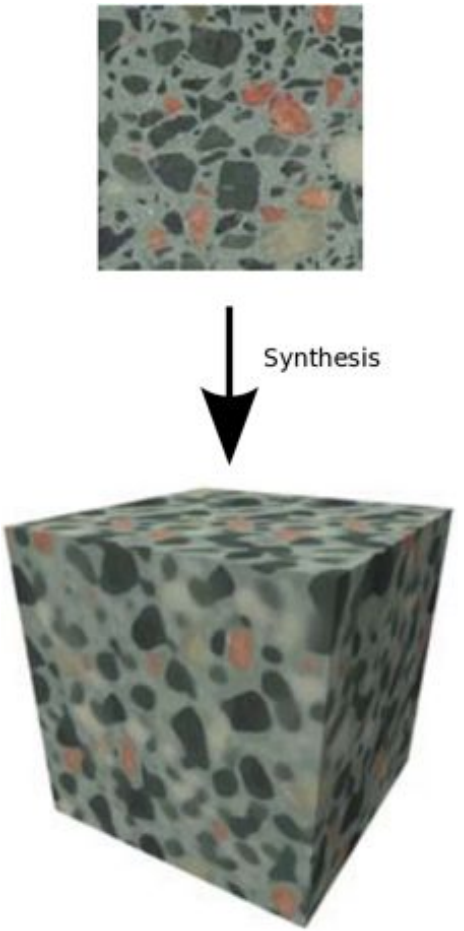
What are 3D Textures?

- Color information in a 3D domain
- Usually a cuboid
  (analog to the rectangle in 2D textures)
- 3D objects can be “carved” out of the cuboid

Motivation

What is 3D Texture Synthesis?

- Creation of the 3D Texture
- Utilizes 2D Textures of the surfaces
- Calculates the inner structure

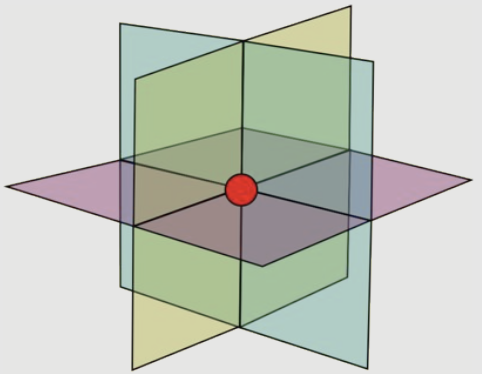


Topics

Solid Texture Synthesis: A Survey

N. Pietroni et al.

- Overview of Texture Synthesis methods
- Methods based on
  1. Neighbourhood matching
  2. Statistical matching

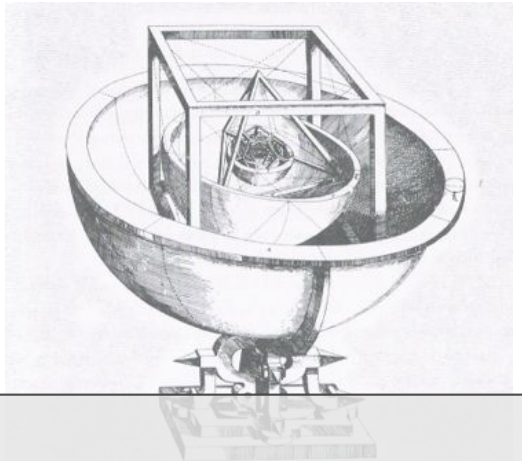


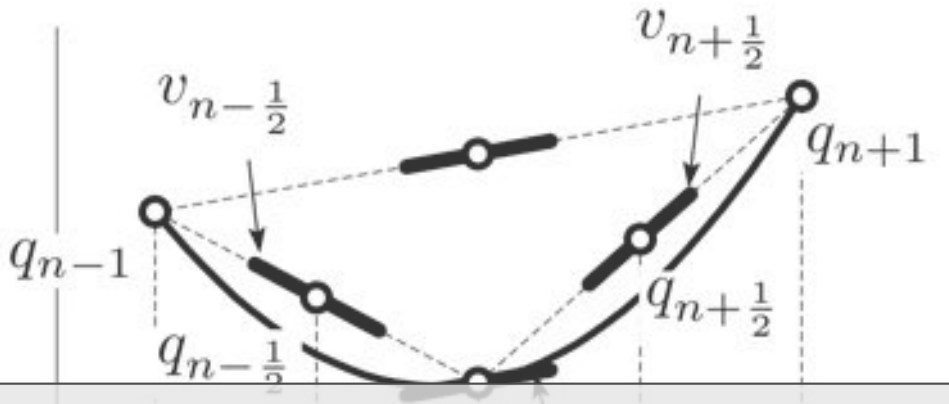
Topics

Solid Texture Synthesis from 2D Exemplars

Kopf et al.

- Improved Texture Synthesis methods
- Faster/Better convergence
- Utilizes histogram matching

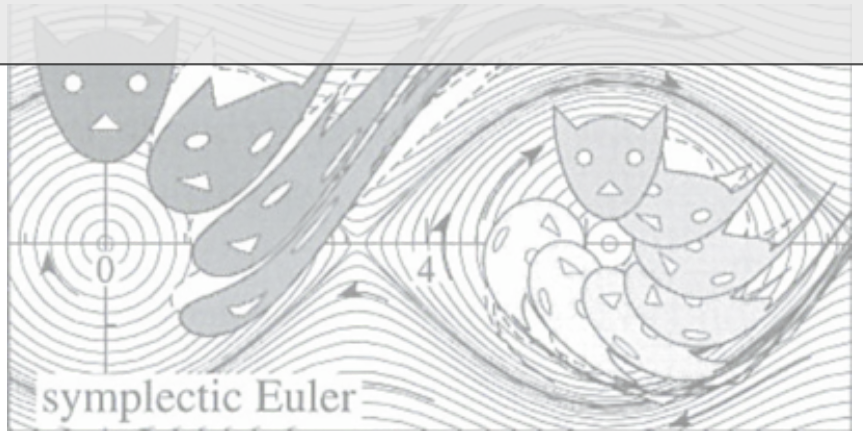




Variational Integration

for

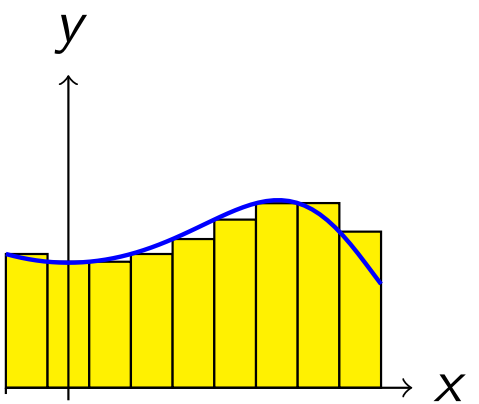
conservative systems



Motivation

$$\mathbf{F} = m \cdot \mathbf{a}$$

- Physical models need integration techniques
- Most techniques are either fast **OR** robust
- Variational integrators can solve a subclass fast **AND** robust



Motivation

What are conservative Systems?

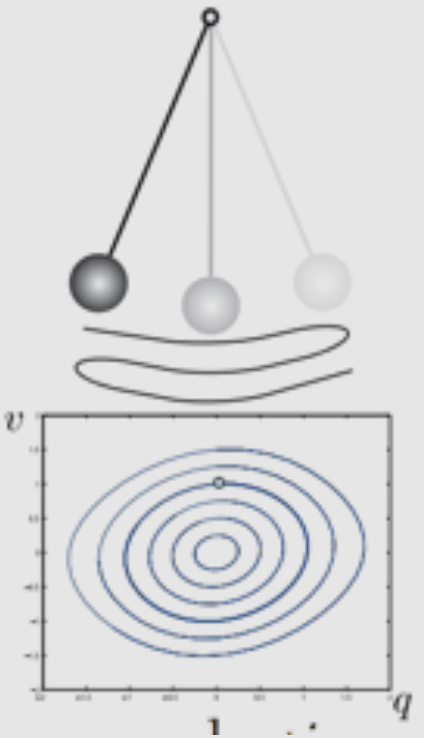
- Energy conserving systems
- All force fields have a potential
- Force fields are irrotational and have no damping

Topics

Discrete geometric mechanics for variational time integrators

A. Stern et al.

- Improved integration techniques
- Use geometric properties
- Conserve momentum automatically
- Better energy behaviour without drawbacks in performance

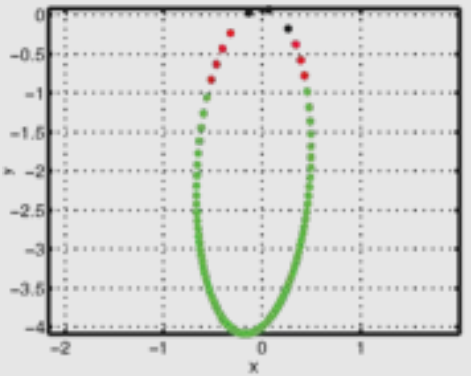


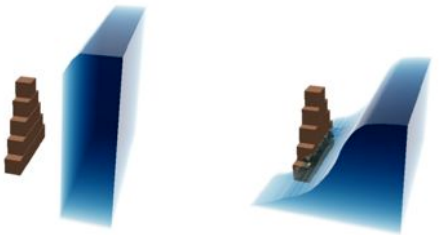
Topics

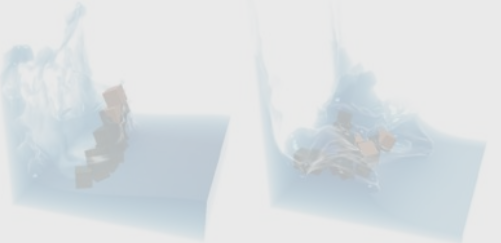
The Jacobi-Maupertuis Principle in Variational Integrators

S. Nair et al.

- Hybrid Integrator based on
  1. *Least action* principle of Jacobi-Maupertius
  2. Hamilton principle
- Switch between integrators
- Use velocity as criterion







Fluid mechanics

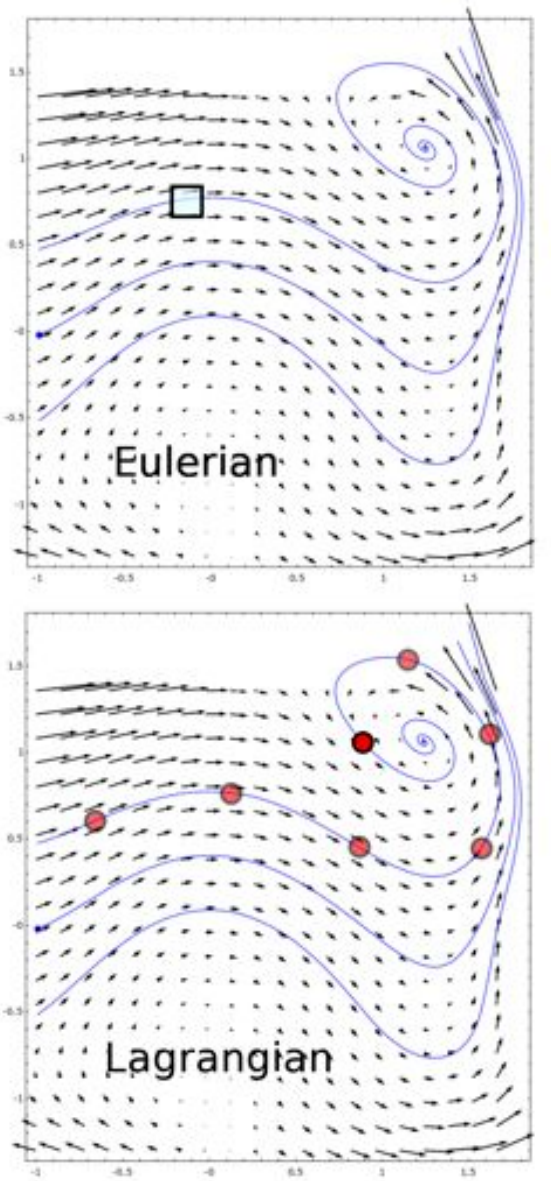
for

Realtime applications

Motivation

How to simulate fluids?

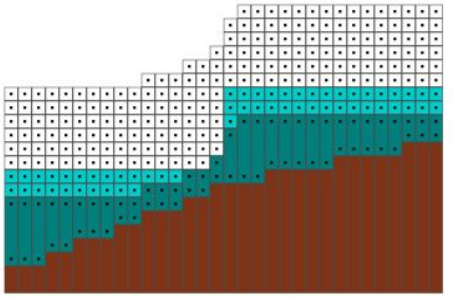
- Methods are categorized into
  - Lagrangian solver
  - Eulerian solver
  - Stochastical methods
  - ...



Motivation

How to improve the simulation?

- Use more sohpisticated models
- Employ possibilities of adaptive algorithms
- Choose the right solvers

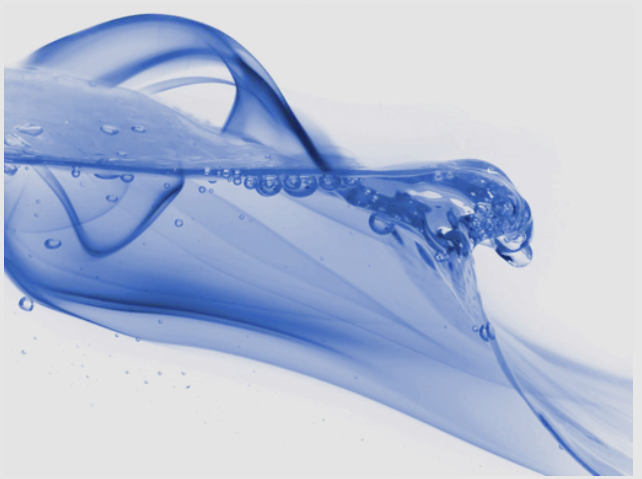


Topics

Advances in Water Resources

H. P. Langtangen et al.

- Overview of common simulation techniques
- Discretization methods
- Splitting techniques

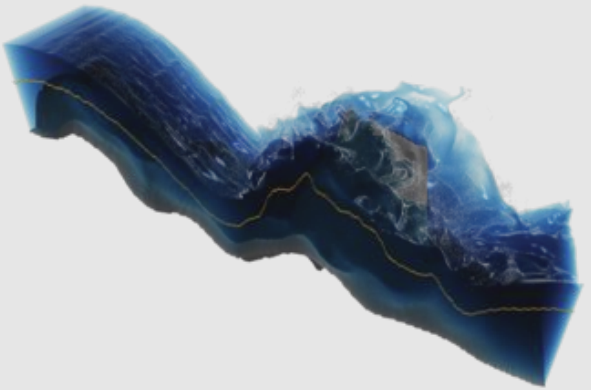


Topics

Tall Cell Fluids

N. Chentanez ,M. Müller

- Adaptive method for eulerian discretization
- Realtime simulation possible
- Little simplification

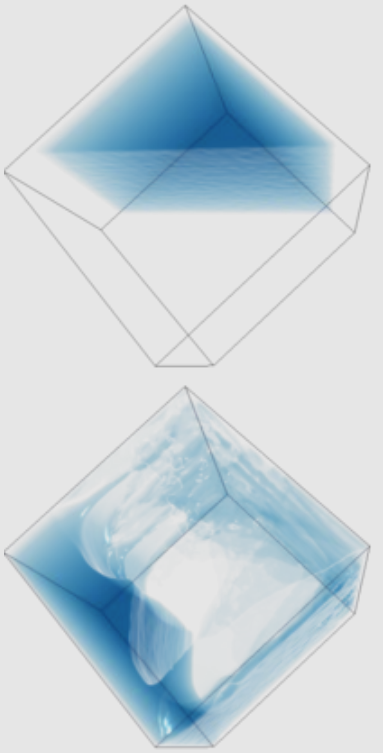


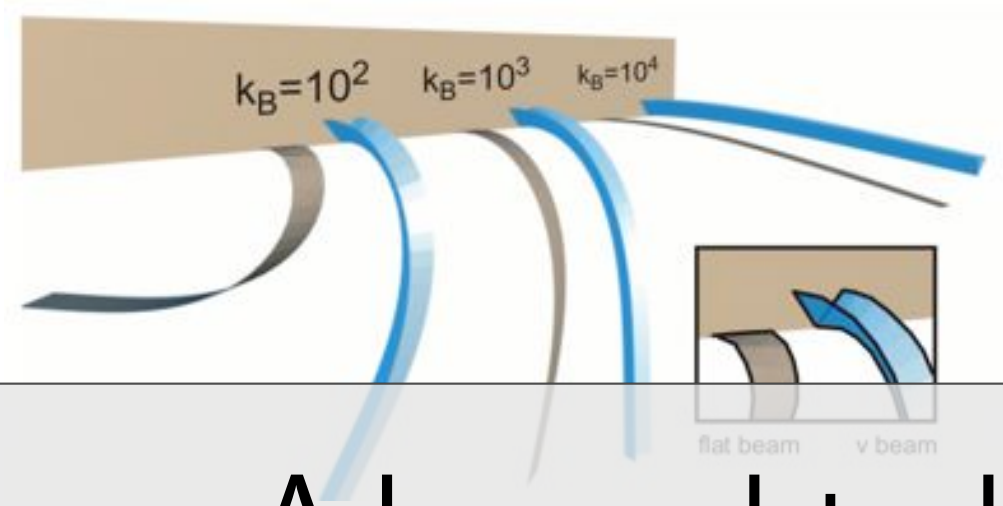
Topics

A Multigrid Fluid Pressure Solver Handling Separating Solid Boundary Conditions

N. Chentanez ,M. Müller

- Support for out/inflow boundaries
- Realtime simulation possible!
- New method for solving the LCP problem
- Utilizes multigrid

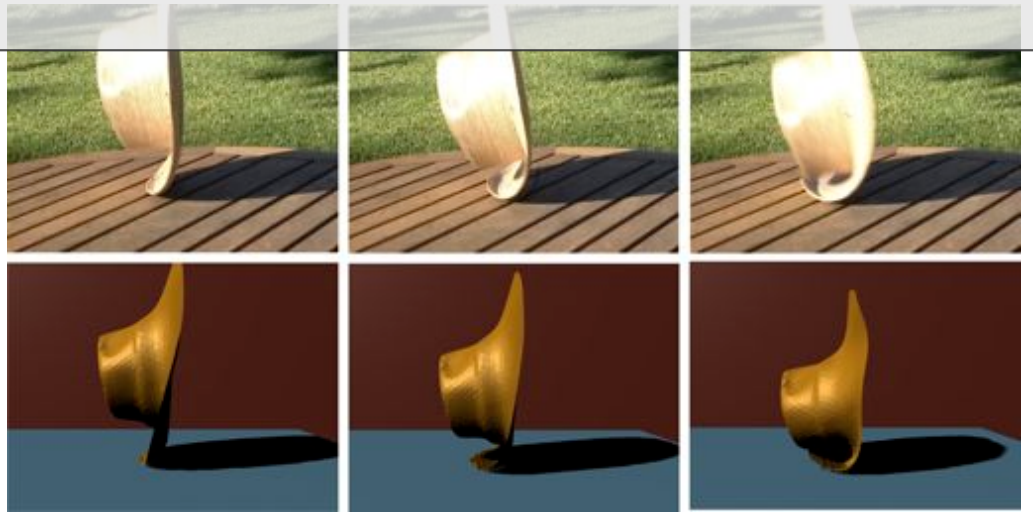




Advanced techniques

for

Deformable objects



Motivation

"State of the Art"-Simulation of Deformable models

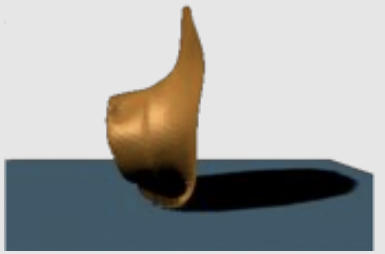
- Simulations are time consuming
- Deformable models require highly sophisticated models
- Algorithms must be fast
- Models shouldn't be to complex
- Difficult to find a balance (fast / complex)

Topics

Discrete Shells

E. Grinspun et al.

- Geometric motivated approach
- Simulating 2D Structurs which are
  - Not stretch- / shearable
  - Bendable
- Deformation based on local curvature



Topics

Discrete Elastic Rods

M. Bergou et al.

- Physical accurate model of rods
- Takes twist of rod into account
- Utilizes Frenet–Serret formulas

Fragen?

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