



OpenTissue

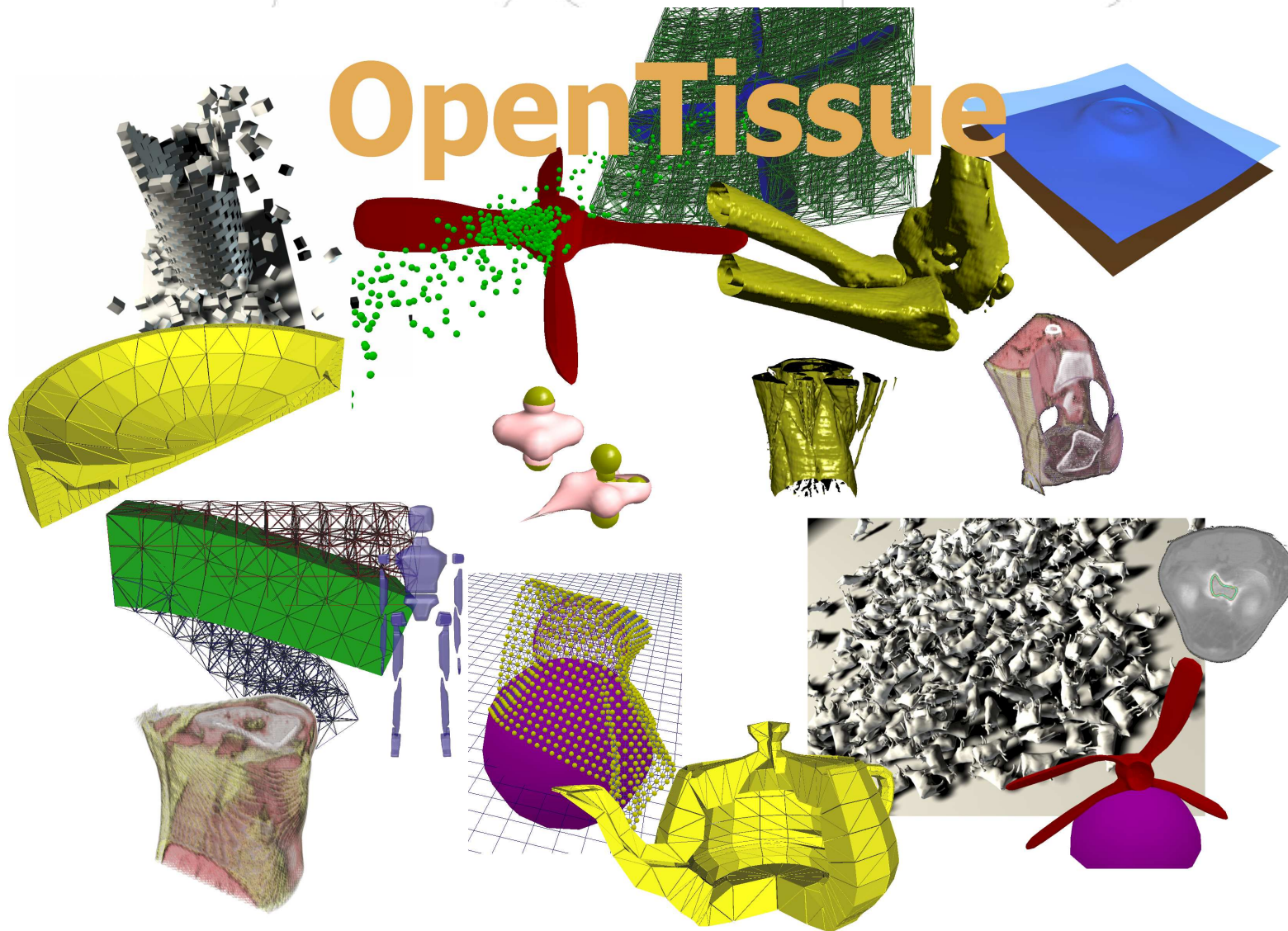
A Low-level, Open-Source, Physics Toolkit

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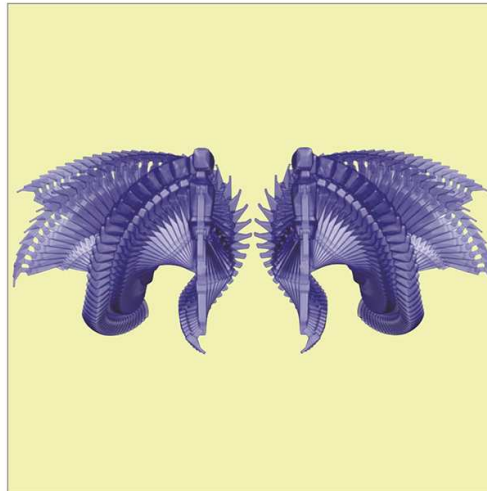
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PHYSICS-BASED ANIMATION

- ◆ Use this definitive reference as the foundation for courses in animation or as a resource for cutting-edge techniques for use in the games and animation industries
- ◆ Find practical methods for transforming theoretical techniques into practical skills
- ◆ Learn how mathematical models are derived from physical and mathematical principles, and how the mathematical models are solved in an efficient, robust, and stable manner on a computer



- **Kinematics:** Articulated Figures; Forward and Inverse Kinematics; and Motion Interpolation
- **Multibody Animation:** Penalty-, Impulse-, and Constraint-Based
- **Deformable Objects:** Particle Systems; Continuum Models with Finite Diffs and Finite Element Method; and Computational Fluid Dynamics
- **Collision Detection:** Broad- and Narrow-Phase; Contact Determination; Bounding Volume Hierarchies; and Feature- and Volume-Based Algorithms
- **Mathematics and Physics:** Vectors, Matrices, and Quaternions; Linear Equation Solvers; Derivative Approximations; Calculus of Variation; Classical Mechanics; Numerical Solution to Differential Equations; B-Spline Theory; OpenTissue





Overview

- History** ● In November 2001, K. Erleben, H. Dohlmann, J. Sporring, and K. Henriksen started to collect a toolbox of code pieces
- As of October 400K lines of code in C++
- Plus** ● Used actively as a Research and Teaching Tool in computer animation
- Latest technology, research and theory is constantly being added, no hidden secrets
- Cross Platform
- Low-level allows user to play around with the details in the simulation methods
- There is mailinglist/phpBB support
- Minus** ● Few third party dependencies: Boost, Atlas, Qhull, TinyXML, NvidiaSDK.
- Low-level requires user to be
 - Experience programmer
 - Have minimum knowledge of physics and numerical methods
- Many contributors means that it takes time for code to mature.



Some Implemented Algorithms

- Rectilinear 3D Grid Data structures and Chan-Vese Segmentation Tools
- Twofold Mesh Data Structure and Tetra4 Mesh Data Structure
- OpenGL based signed distance map Computations and Voxelizer
- Quasi Static Stress-Strain Simulation (FEM)
- Relaxation based Particle System Simulation
- Dantzig LCP Solver, Path and Lemke wrappers (LCP solvers)
- CJK, SAT, VClip
- Mesh Plane Clipper and Patcher, QHull Convex Hull wrapper
- Script files for Maya and 3DMax
- Generic Bounding Volume Hierarchies
- Multi-body Dynamics and Volume visualization
- Constitutive Elastic Model for deformable objects
- Smoothing Particle Hydrodynamics
- ...



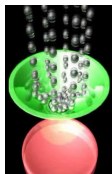
Visualization



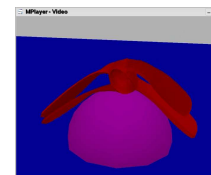
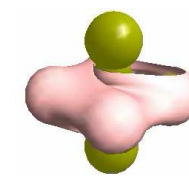
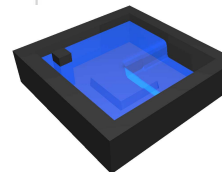
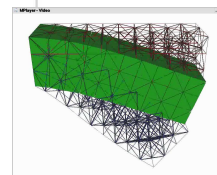
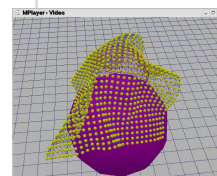
Segmentation



Rigid Bodies



Deformable Objects





Future Plans

- Many contributors and ad-hoc extensions, implies that code needs to be matured. We are currently looking at automatic testing systems.
- Generic Programming style will be enforced everywhere in OpenTissue.
- OpenTissue will continue to be used and updated for graduate teaching in Physics Based Animation at DIKU
- More simulation methods will be added.

A large, faint geometric diagram in the background, consisting of several overlapping circles and arcs, resembling a complex geometric construction or a stylized logo.

www.opentissue.org