Syllabus

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Syllabus

List of topics

- **Topic 1 - basic concepts from physics**: translational and rotational Newtonian physics, numerical integration, equations of motion for a system of bodies
- **Topic 2 - narrow phase of collision detection**: separating axis, collision response
- **Topic 3 - broad phase of collision detection**: axis aligned bounding boxes, bounding spheres, etc.
- **Topic 4 - simultaneous resolution of multiple constraints**: constraints as a system of equations, the Gauss-Seidel method
- **Topic 5 - force computation**: ballistic forces (Magnusson, friction, gravity), car forces, plane forces, etc.

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- **Optional topic 1 - preprocessing of models for collision detection** BSP for faster collision detection
- **Optional topic 2 - preprocessing of generic models** calculating the *inertia tensor* of arbitrary polytopes

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List of materials

- The book *Game Physics - Second Edition*, by David Eberly
- The book *Physics for game programmers*, by Grant Palmer
- The paper *Iterative Dynamics with Temporal Coherence*, by Erin Catto
- The tutorial *Car physics for games*, by Marco Monster
- The Siggraph '97 course notes *An Introduction to Physically Based Modeling: Rigid Body Simulation I - Unconstrained Rigid Body Dynamics* by David Baraff

Assignments

- Due
  - The end of the week after presentation in class (possible time bonus)
  - All together at the end of the course
- Group work for coding (max three students)
- Individual work for the report (what will actually be graded)

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List of assignments

- Build a basic kinematic simulator with RK2 or RK4 (20%)
- SAT/contact manifold computation (at least for OBBs, better for arbitrary meshes) (20%)
- Collision culling with bounding spheres, AABBs, and bins (20%)
- Collision response (20%)
- Forces for domain-specific scenarios (20%)

That's it

Thank you!