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TECHNISCHE
UNIVERSITÄT
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„Game Technology“
Winter Semester 2014/2015

Example Problems for Lecture 8 “Physics 1”

1. Important topics

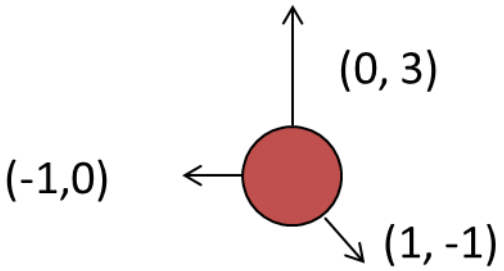
Newton’s laws, especially no. 2 (F = ma)
Understand force, mass, acceleration
D’Alambert’s principle (→ accumulator for forces)
Particles
Particle (systems), difference between particle and rigid body
Particle system parameters
Particle rendering methods
Euler integration for physics simulation
→ Get from F = ma to the differential equations
Rigid Bodies
Center of mass, application of forces on-center, off-center
→ Moment of inertia
Collision Detection
Sphere-sphere
Sphere-plane
Collision Response
Collision normal
Separating velocity
Calculate impulses
Solve interpenetration
Apply impulses

2. Example Problems

2.1 Newton’s laws

a) Name the terms of the formula F = ma and explain their meaning.

b) Calculate the overall force acting on the depicted object using D'Alambert's law.



2.2 Particle Systems

a) Name the main property that distinguishes particles from rigid bodies

b) Given the view matrix of a camera, explain how a particle can be rendered as a quad that always faces the camera.

2.3 Rigid Bodies

a) Name the main property of rigid bodies that distinguishes them from particles.

2.4 Collision Detection and Response

a) How can we determine whether two circles are intersecting? State which properties of the situation are needed and how they are used.

b) Assume that two circles are intersecting. Name the relevant properties we need for collision response and how they would be used.