



„Game Technology“ Winter Semester 2014/2015

Example Problems for Lecture 9 “Physics 2”

1. Important topics

Separating Axis Test

Understand how and why the SAT is applicable

Understand relevant features

SAT for sphere-sphere

SAT for triangle-sphere

Space partition algorithms

Understand the purpose

Regular grid

Quadtree/Octree

KD-tree

Binary Space Partition

Broad Phase vs. Narrow Phase

Understand the difference

Rotation, Torque

Explain the difference between angular velocity + acceleration compared to linear

Mass moment of inertia, Inertia Tensor

Torque

Compute torque

Friction

Coulomb's law

Understand the relationship between friction force, coefficient of friction and normal force

Explain the purpose of a contact basis

2. Example Problems

2.1 Separating Axis Test

a) Which of the following statements is true about the Separating Axis Test? Explain each answer.

1) When more than 50% of the individual feature tests have been negative (= no separating axis found), we can stop the testing.

2) When more than 50% of the individual feature tests have been positive (= a separating axis was found), we can stop the testing.

3) When the first negative feature test is found, we can stop calculating.

4) When the first positive feature test is found, we can stop calculating.

5) We always need to test all features.

6) For a circle, the SAT can not be applied as it has no distinct features.

2.2 Space partitioning algorithms

a) What is the main difference between a quadtree and a kd-tree?

2.3 Broad phase vs. narrow phase

a) In which phase of collision detection would we typically use a space partitioning algorithm as in task 2.2? Explain your answer.

2.4 Rotation, Torque

a) Imagine an object in outer space without gravitation or other forces acting on it. Is it possible to apply a single force to this object that does not induce a rotation? Explain your answer.

b) Which formula is used to compute the torque t acting on an object based on force f and the point of application of the force, p ?

2.5 Friction

a) Which three values are used in Coulomb's law? What is their meaning and what is the relation between them?

b) Why is it beneficial to work with a contact basis when calculating the effects of friction?