Lab 6: Particle3D & Integration in 3D

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GPR-350 Game Physics
Instructor: Daniel S. Buckstein
Lab 6: Particle3D & Integration in 3D

Summary:
This week we enter 3D physics by revisiting integration and introducing quaternion-based rotation.

Submission:
Submit a link to your online repository with the completed assignment's branch name and commit ID/index. If you have not created an online repository to keep track of your work, you should do so as part of this assignment; it will be checked. ***Work in pairs***.

Instructions:

Implement a 3D particle interface similar to our 2D particle interface. The following changes must be made for 3D:

- Position, velocity, acceleration and force are 3D vectors (from a 2D vector in 2D)
- Rotation is a quaternion (from a single float about the Z-axis in 2D)
- Angular velocity, angular acceleration and torque are 3D vectors (from single floats about the Z axis in 2D)
- Implement your own operators for quaternion multiplied by scalar
- Implement your own function for multiplying a 3D vector with a quaternion (not the same as rotating!)

Implement the same integration algorithms found in the 2D interface but for 3D. At minimum, implement functions that perform:

- Euler's method for position and velocity
- Euler's method for rotation and angular velocity
- Kinematic formula for position with Euler's method for velocity

Test all algorithms using function-controlled acceleration/angular acceleration; do not worry about force and torque, that will be the next lab!

Bonus:
Implement one of the following:

- Correctly implement kinematic integration for 3D rotation (kinematic formula for rotation, Euler's method for angular velocity).
- Implement your own quaternion class extending the 4D vector class.

Points 8

Submitting a text entry box

Due	For	Available from	Until
-	Everyone	-	-

+ Rubric