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IGR 202
Rigid Body Simulation
Report

# IGR 202 TP Rigid Body Simulation

***Student :***
Rafael Benatti

***Professor :***
Kiwon UM

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# 1 Rigid Body Attributes

This section covers the section 2 of the TP, where I was meant to calculate the mass and inertia momentums of the body. Initially I didn't understand how I would calculate the mass, but than I took a better look in the variables of the class and I saw that I could use the density. To calculate the inertia momentum I entered wikipedia to get the momentum of a cube. I made a mistake here and spent much time on it that was using (1/12) without point, so my I0 was compound only of zeros. So, to calculate the inverse I was getting errors that said that was impossible to calculate the determinant, and as so, the matrix would be non invertible, so I analyzed it better and so that it was because it was compound only of zeros, so I changed the data type to double (1.0/12.0).

# 2 Time integration

For this part I had trouble to understand what I should integrate, because I wasn't seing where the values of force and tau would change, so I could have a significant integration. So I skiped this part and went to force topic, where I understood what was happening, than I came back and did the integration part, for this integration part I followed the slide 21 from the slide presentation which made the implementation pretty much straightforward.

# 3 Force and Linear Momentum

In this part I didn't had much problem, the dice did a parabolic movement but without rotating.

# 4 Torque and angular velocity

For this part it wasn't much clear how I could calculate the torque in a point. After researching and thinking a lot, I got to the conclusion that I would need a vector pointing from the center of gravity of the body (which acts like the fix points of a arm lever) and then calculate the product of this vector and the force.

To get this vector I calculated the cross product matrix between the rotation matrix and the point which I wanted to apply the force (naturally, I would subtract the point and the center of gravity of the body, but the center of the body was (0, 0, 0). Than I multiplied this matrix by the force in the point if the step was equal to 1.

To apply the torque and get a speed from it I went to the step function and did practically a clone from the linear part, changing the variables but with the same idea.

This worked but I thought it wasn't working because in the text of this says that I would be seeing the dice rolling in the parabolic trajectory, but actually the dice deformed really fast and I couldn't see that the parabolic fall was still working. So I reduced a lot the force and saw that it was working, but I still thought it wasn't good and skipped to the next part, where was written that it would probably not work properly.

# 5 Quaternion

For this part I didn't knew much about quaternions, so I watched this video :
https ://www.youtube.com/watch ?v=zjMuIxRvygQ
and read a bit on internet. To get help from operations I visited some websites, mainly wikipedia and managed to recreate the operations.