Beyblade Project

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1 Project Description

1.1 Introduction

The Beyblade Project, named after an anime about brave warriors battling with spinning tops, aims to allow the user to observe spinning tops of different shapes evolving according to their chosen initial values and numerical integrators among the following choices :

1.2 Tops :

— Conical Top (ConeSimple)
— Chinese Top
— General Conical Top (a conical top with more general evolution equations)
— Energy Conical Top (a conical top with evolution equations based on energy)

1.3 Integrators :

— Euler-Cromer (for 1^{st} and 2^{nd} degree equations)
— Newmark (only for 2^{nd} degree)
— Runge-Kutta (for 1^{st} and 2^{nd} degree equations)

Note : The General and Energy Conical Tops have some issues with their evolution equations. The Euler-Cromer integrator does not seem to be suitable for the Chinese Top as it diverges rapidly.

1.4 Improvements

Several improvements, which are the pride of their creators, have since been added to the project, such as (non-exhaustive list) :

— Ability to add tops with variable height, radius, and shape.
— Ability to choose whether the tops move in space or remain fixed in one place.
— Ability to display the trace of their axes of symmetry.
— Ability to save the state of multiple tops and load old saves with certainty of their authenticity.
— Top colors vary based on their rotation speed.
— Creation of bouncing balls.
— A WTF mode.

And much more...

2 Beyblade Installation

1. Open Beyblade/project/beyblade.pro, QtCreator should open, press Ctrl+R or click the run button at the bottom right.
2. An error "No rule to make target.." may appear (we have not been able to make it disappear). A folder named build-beyblade-"Selected Kit" should have been created in the Beyblade folder.
3. Move the files "music.wav" and "toupie.png" from Beyblade/project/Qt_GL to Beyblade/build-beyblade-.../QT_GL.
4. Go back to QtCreator and run again, the program should start now.

3 Using Beyblade

3.1 Configuring initial parameters

Once the project is executed, two windows should appear, one with the authors' photo and a description such as "By Arthur and Jojo" and the other being a configuration panel titled "Toupie N^{o}1". In the latter, you can select the type of top, the integrator, the initial values of the angles (in radians) and their derivatives as well as the initial position of the top. Then press *Validate*.

The selected top should then appear on the first mentioned window.

3.2 Launching and interacting during execution

To set the top in motion, press the *Space* key on your keyboard. Press it again to pause. Several other keys on your keyboard allow you to interact with the program :

u Allows tops to move in space (press again to cancel).
y Displays the *trace* of the top (extension of the vector (contact point - center of gravity)).
w Launches a randomly colored ball.
t Launches the *WTF* option, which puts the arena in full screen mode and disrupts the current program.
o Decreases dt for better precision.
p Increases dt.
F2 Activates full screen mode.
ESC Exits the program.

3.3 Camera movement

The camera moves in a spherical coordinate system centered at the origin. It is not possible to change this system.

z Zoom.
s Unzoom.
q Rotates the camera counterclockwise.
d Rotates the camera clockwise.
h Resets the camera.
— The *arrow keys* allow you to move in the spherical coordinate system centered at the origin.

— The mouse (while holding down the left click) can also be used to move the camera.

3.4 Advanced parameters

For the smooth execution of these operations, pause the program. In the program options, several choices are available to you :

3.4.1 Add a top

Reopens the configuration panel to add a top to the arena.

3.4.2 Delete a top

Deletes the selected top.

3.4.3 Saving and loading old backups

Save the system opens a window allowing you to select the file name where the tops will be saved, as well as its location. (If a file with the same name already exists, it will be replaced). The backup file thus created contains a security code generated by a hashing function to verify the authenticity of the document when it is reopened.

3.4.4 Information

A window appears. Select the bey of your choice to get information about it.

3.5 Running tests

To run a test, simply :
— "Uncomment" the test you are interested in in main_text.cc
— Click on the icon above the green execution arrow
— Select text and compile.

4 Developed with

The Beyblade project was coded in *C++* from the *Qt Creator IDE, version 5.14.1,* where several of its libraries were used.