Master Project

User Manual

(Photo courtesy of Need for Speed Most Wanted – BMW M3)

Contents

1. Setup and configuration

The application has been setup with default values; you may run it right away. However, if you do need to change the configurations please refer to the following guidelines.

1.1 Terrain

Put the models of the terrain in .obj format in the folder "models/terrain". To change the terrain model, edit the file "terrain.txt" in the folder "data" and change the first line to the path of the terrain model such as

"models/terrain/terrain.obj".

1.2 Terrain Type

To add a terrain type, edit the file "terrain.txt" in the folder "data" and add the terrain type and the region in the format such as the following example.

textures/terrain.tif -> texture to be used

0 -> x coordinate (from)

0 -> z coordinate (from)

50 -> x coordinate (to)

50 -> z coordinate (to)

128 -> rolling resistance

0.04 -> maximum height variation

To add another type of terrain, just add another set of data such as the following example.

textures/terrain.tif
0
0
50
50
128
0.04
-50
-50
-25
-25
64
0.02

1.3 Gear ratios

To change the gear ratios, edit the file "gear.txt" in the folder "data" and edit the gear ratios such as the following example. (You may add from 1 to 6 gears.)

```
3.82 -> 1st gear

2.20 -> 2nd gear

1.52 -> 3rd gear

1.22 -> 4th gear

1.02 -> 5th gear

0.84 -> 6th gear
```

1.4 Car

Three models of the car (mclaren, micra, and minibus) have been provided in the folder "model". To add more model create a folder in the folder "model" and add 2 .obj files one for the wheel and one for the car body. The head of car's body must point toward the positive x direction. The axis of rotation for the wheel to revolve must be the z-axis.

Default configurations of these cars have also been provide in their folders. To use these configurations, copy the file "config.txt" and "gear.txt" and place them in the "data" folder.

Please follow the following example to configure the parameters for a car. (Parameters must be in this order).

1500 -> Mass of the car in Kg

2.785 -> Wheel base in m

0.874866 -> Distance from CG to wheel in m (a)

1.265633 -> Distance from CG to front axle in m (b)

1.519292 -> Distance from CG to real axle in m (c)

0.9 -> Distance from CG to body in m (a2)

0.887725 -> Distance from CG to front body in m (b2)

1.106715 -> Distance from CG to rear body in m (c2)

0.18 -> Distance from CG to lower body in m (e)

0.38 -> Height of CG from the ground in m

2.346217 -> Length of CG to rear bounding box in m (rbbl)

2.353915 -> Length of CG to front bounding box in m (fbbl)

0.648553 -> Height of CG to rear bounding box in m (rbbh)

0.457498 -> Height of CG to front bounding box in m (fbbh)

4.728 -> Length of the car in m

2 -> Width of the car in m

1.258 -> Height of the car in m

0.686 -> Size of the tire in m

0.8 -> Rate of steering in degree

45 -> Maximum angle of steering in degree

7 -> Maximum camble angle in degree

-5.2 -> Cornering stiffness of rear wheels (must be negative)

-5 -> Cornering stiffness of front wheels (must be negative)

3 -> Maximum normalized friction force (diameter of friction circle)

0.12 -> Rest length of the spring of the rear chassis in m

0.18 -> Rest length of the spring of the front chassis in m

0.06 -> Length of the links on the rear chassis in m

0.02 -> Length of the links on the front chassis in m

30000 -> Spring constant of the rear chassis in N/m

30000 -> Spring constant of the front chassis in N/m

3 -> Maximum angle that the body roll when cornering in degree

0.4257 -> Factor for air resistance (air drag)

12.8 -> Factor for rolling resistance

7200 -> Redline in RPM

3.44 -> Final drive ratio

1 -> Automatic transmission flag (1 = auto, 0 = manual)

1 -> Acceleration rate of reverse gear in m/s^2

10.4 -> Vehicle deceleration rate in m/s^2

models/mclaren/mclaren.obj -> File path of the car's body model (Must be in .obj)

models/mclaren/wheel.obj -> File path of the car's wheel model (Must be in .obj)

The following diagrams illustrate how to determine the length of a, b, c, a2, b2, c2, e, rbbl, fbbl, rbbh, and fbbh.
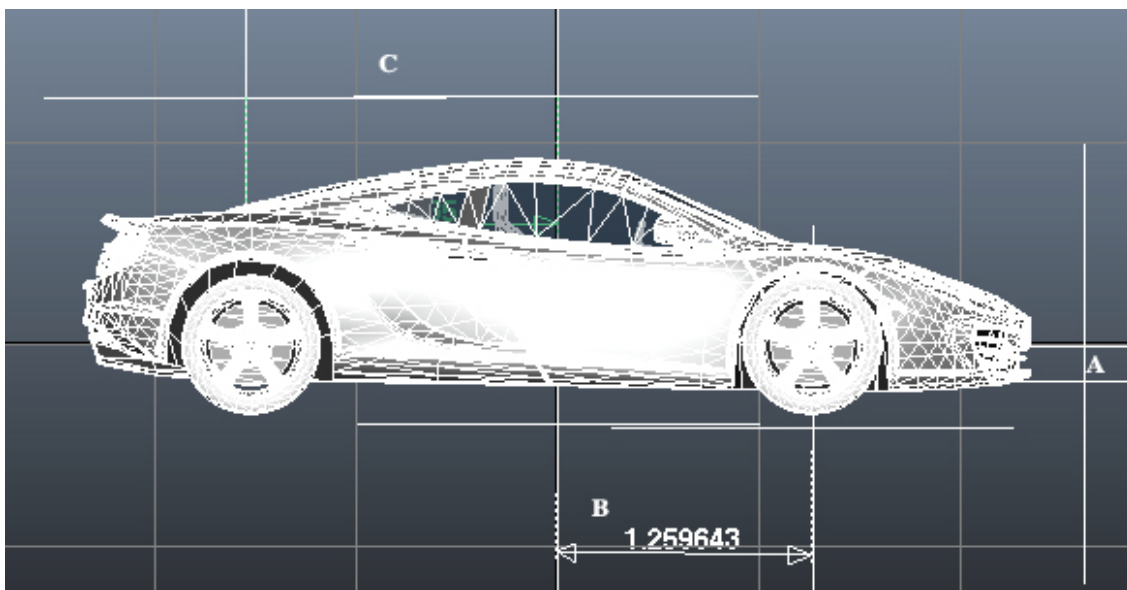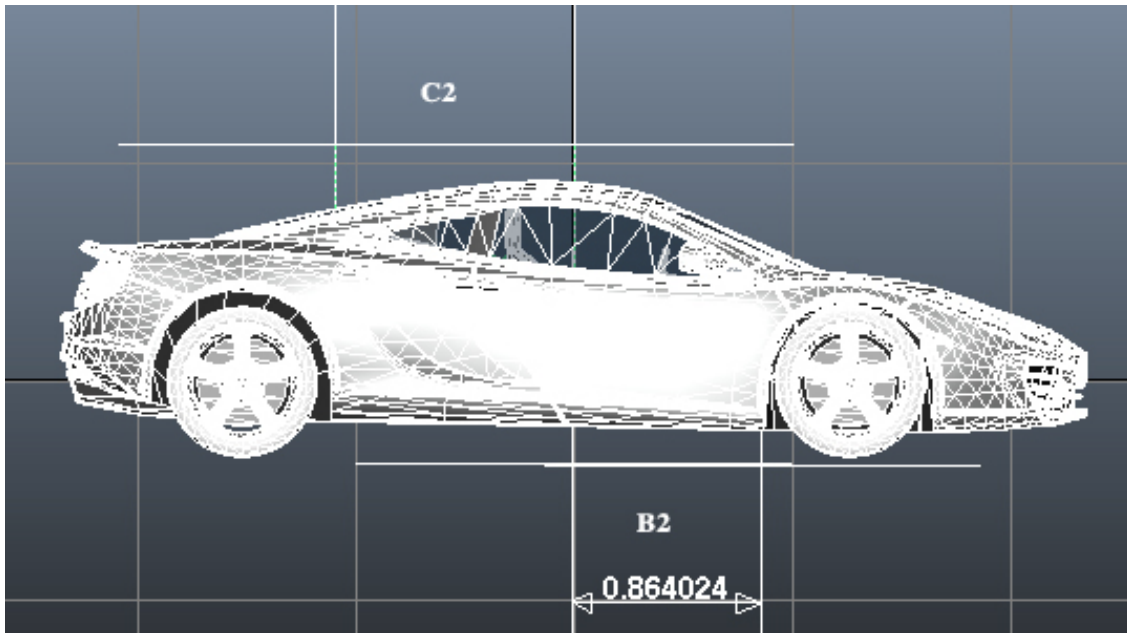

Figure 1-1: b and c
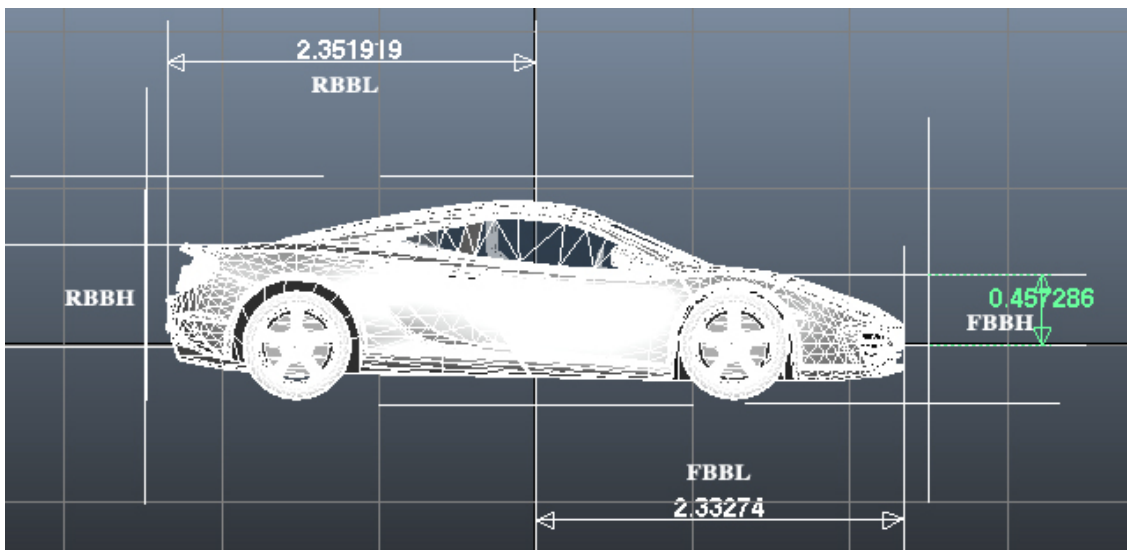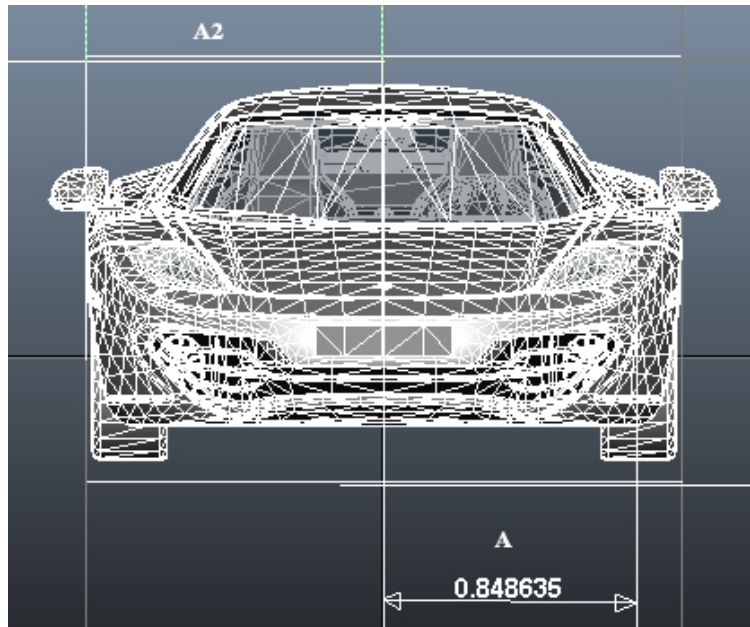
Figure 1-2: b2 and c2

Figure 1-2: rbbl, fbbl, rbbh, and fbbh

Figure 1-3: a and a2

1.5 Scene

To change the number of cars, edit the file "scene.txt" in the folder "data" and edit number of car in the first line to be 1 or 2.

2. Controls

Use the following keys to control the cars.

First Car
Up -> Throttle up
Down -> Throttle down
Left -> Steer left
Right -> Steer right
Alt -> Use reverse gear
N -> Shift down a gear
M -> Shift up a gear
Spacebar -> Brake

Second Car
W -> Throttle up
S -> Throttle down
A -> Steer left
D -> Steer right
E -> Use reverse gear
R -> Shift down a gear
T -> Shift up a gear
Q -> Brake