Fingsics User Manual

The files needed to run Fingiscs on Windows x64 can be found in the `binaries` directory. In this folder there is a `Fingsics.exe` to run the application, a config file named `config.txt`, a folder named testing that contains the expected results for the testing functionality, and a folder named scenes that contains many example scenes that can be run.

All the scenes start in the *paused* mode, so for the simulation to begin the P key has to be pressed.

In this document we will explain how to create new scenes, how the config file works, the controls of the application, and where are the outputs are generated.

Run modes

In Fingsics there are 4 different run modes:

1. DEFAULT: It is the main mode, where scenes can be run in real time generating logs and recordings.
2. REPLAY: Allows to run a replay based on a recording
3. BENCHMARK: Allows to run a scene many times without rendering it, generating reports with data about the runs.
4. TEST: It was implemented for development, it generates logs of many scenes that can be then compared to the expected results.

Config file

Using this file the behaviour of Fingsics can be modified. In the binaries folder there is an example `config.txt` file. The properties that are defined in the file are the following:

- **SCENE_FILE_NAME**: Here the name of the XML scene file must be specified (without the extension). This file must be inside the `scenes` folder.
- **FPS_CAP**: Number of physics applications (collision detection and response) for each second of the simulation. If the hardware allows to run more than this number of iterations per second, the thread is put to sleep to maintain this maximum FPS.
- **FULLSCREEN**: Boolean that indicates whether to run on fullscreen or not.
- **WINDOWED_WIDTH**: Horizontal screen resolution for windowed mode.
- **WINDOWED_HEIGHT**: Vertical screen resolution for windowed mode

- **LOG**: Boolean that indicates whether to generate a CSV log file with data of the run or not.
- **RECORD_SCENE**: Boolean that indicates if the simulation should be recorded in Fingsic's format.
- **RECORD_VIDEO**: Boolean that indicates if the simulation should be recorded in video format (MPG).
- **DRAW_AXES**: Boolean that indicates whether the coordinate system axes should be drawn or not.
- **OBJECT_DEFINITION**: Integer that specifies how precise the drawing of bodies should be. A bigger value means the bodies are drawn better, but the performance decreases. A value between 5 and 20 is recommended.
- **SHOW_FPS**: Boolean that indicates whether the current FPS should be drawn or not..
- **BROAD_PHASE**: Choice of the BPCD algorithm for the simulation. The choices are: NONE, AABB, OBB, SAP and SAPOBB.
- **RUN_MODE**: Which run mode to use. Choices are: DEFAULT, TEST, BENCHMARK and REPLAY.
- **NUM_RUNS_FOR_BENCHMARK**: Number of times that the scenes are run when using the *BENCHMARK* mode.
- **SCENE_REPLAY_FOLDER_NAME**: Name of the auto generated folder inside the `output` directory that contains the replay that should be run. This must be specified to use the *REPLAY* mode.
- **STOP_AT_FRAME**: Frame number where the simulation ends. If `-1` is inputted, the simulation will run until it is manually stopped.

Controls

Since *TEST* and *BENCHMARK* modes don't render the scene, they don't have any interface nor controls (they simply show a black screen when running). The *DEFAULT* mode has the following controls:

- **Camera mode**: Using the C key the camera mode can be changed between Centered Camera and Free Camera. In the free mode the camera can be moved and pointed towards anywhere, while in the centered mode the camera always points towards the center of coordinates.
- **Centered camera**: Using the S and W keys the distance of the camera to the center of coordinates can be changed, and moving the mouse while pressing its right button rotates the camera with respect to the origin.
- **Free camera**: Using the W, A, S, D, LCTR and SHIFTkeys the camera can be moved, and moving the mouse while pressing its right button changes where it points to.
- **Bounding volume drawing**: With the I and O keys you can enable/disable the drawing of AABBs and OBBs, respectively.

- **Simulation controls**: The P pauses/resumes the simulation, and the M key activates slow motion. To finish the execution you can close the window or press the Q or ESC keys.

Besides all this, when using the *REPLAY* mode, you can press the arrow keys, the dot and the comma to move the simulation forwards or backwards by fixed time intervals.

Scenes

The name of the scene to run must be specified in the configuration file. To implement a new scene, a new XML file has to be created in the `scenes` folder, following the format of the existing scenes. Here is a simple scene with one of every kind of body in Fingsics:

```
<?xml version="1.0" encoding="utf-8"?>
<config>
	<camera rad="171" pitch="-50" yaw="58"/>
	<objects>
		<tile pos="0,0,5" length="3" width="3" static="true" />
		<sphere pos="0,5,0" radius="1.5" />
		<capsule pos="5,0,0" radius="0.5" length="4" />
	</objects>
</config>
```

The initial configuration of the camera is optional and, if it is defined, will point towards the center of coordinates with the *radius*, *pitch* and *yaw* specified.

To create a sphere a *radius* must be defined, to create a capsule a *radius* and a *length*, and to create a tile a *length* and a *width*. All tiles must be static.

All bodies have the following properties that can also be defined in the XML:

- **pos:** Initial position of the body, a point in three dimensions.
- **vel:** Initial velocity of the body, a point in three dimensions.
- **acceleration:** Acceleration of the body, a point in three dimensions.
- **ang:** Initial angle of the body, a point in three dimensions, where each coordinate represents the initial rotation with respect to the axis that corresponds to that coordinate.
- **angVel:** Initial angular velocity of the body, a point in three dimensions, where each coordinate represents the initial angular velocity with respect to the axis that corresponds to that coordinate.
- **mass:** Mass of the body, a number.

- **elasticityCoef:** Elasticity coefficient of the body, a number.
- **static:** Boolean that specifies whether the object is static or not.
- **draw:** Boolean that specifies whether the object should be drawn or not.
- **color:** Color of the object, a point in three dimensions in RGB format.

Output

The outputs generated when running on *DEFAULT* mode are saved in a folder named `output`. In this folder, for each simulation that has an output, a folder with the name of the scene and the date is created, where the logs and recordings are saved (if it is specified in the config file that they should be saved),

The outputs of the *TEST* mode are saved in the `testing` folder, and the ones of the *BENCHMARK* mode in the `benchmarks` folder.