physics-engine.md

2D Physics Simulation

A powerful and versatile 2D physics simulation engine supporting both rigid and soft bodies.

How to Use

1. **Download** the release version for your operating system.
2. **Extract** the downloaded folder.
3. **Run the executable** based on your OS:
   - **Windows X64**:

     ```
     ./PhysicsEngine-1.0.0-winX64/PhysicsEngine.exe
     ```

   - **Mac X64**:

     ```
     ./PhysicsEngine-1.0.0-macX64/PhysicsEngine.app/Contents/MacOS/PhysicsEngine
     ```

   - **Linux X64**:

     ```
     ./PhysicsEngine-1.0.0-linuxX64/PhysicsEngine
     ```

4. If you encounter a "Permission Denied" error, run the following command to set the correct permissions:

   ```
   chmod 700 <path to file>
   ```

Features

- **Support for Multiple Shapes**
  - Triangle, Square, Hexagon, Octagon, and Circle

- **Interactive Gravity Slider**
- **Customizable Properties**
  - Adjust mass, size, and rotation
- **Static Objects**
  - Non-moveable objects for dynamic interactions

Controls

General

- **Choose a Shape**: Select one of the six available options.
- **Spawn a Shape**: Left-click in an open area of the field.
- **Move a Shape**: Use the **WASD** keys.
- **Select a Shape**: Left-click on the shape you want to control.
- **Delete a Shape**: Select a shape and press **Tab**.

Modifying Shape Properties

- **Change Mass**:
  - Enter a positive floating-point value in the input field.
- **Change Side Length**:
  - Enter a positive integer in the input field.
- **Set Creation Rotation**:
  - Enter a positive or negative integer in the input field to define the spawn angle.

Additional Features

- **Spawn Static Shapes**:
  - Enable the static option to spawn non-movable shapes.
- **Switch to Soft Bodies**:
  - Enable the soft body option to use soft-body physics.
  - **Note**: Circles are made up of 20 sides, so it's recommended to choose a low side length (1-100).
  - **Switch Models**: Press **M** to toggle between the spring-pressure model and the spring-shape matcher model.

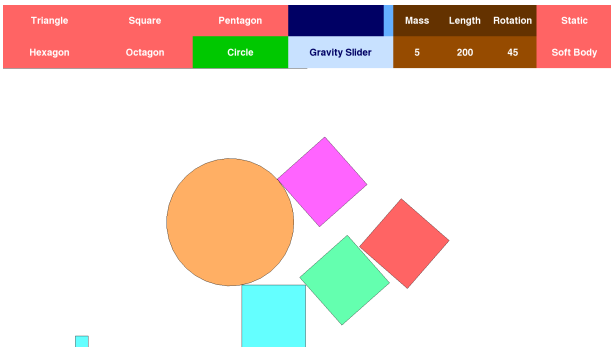
Known Issues with Soft Bodies

- **Triangle Stacking**:
  - Triangles do not stack well due to pixel-perfect edge collisions, leading to infinite displacement.
- **Mass Discrepancy Collisions**:
  - Collisions between very heavy objects and significantly lighter ones can result in unpredictable behavior.

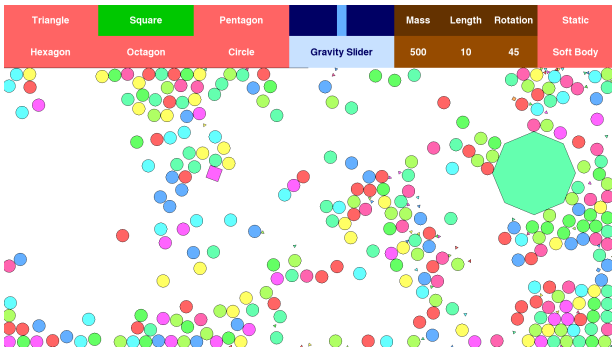
Rigid Bodies

Explore the simulation of rigid bodies with realistic physics interactions.

Example 1



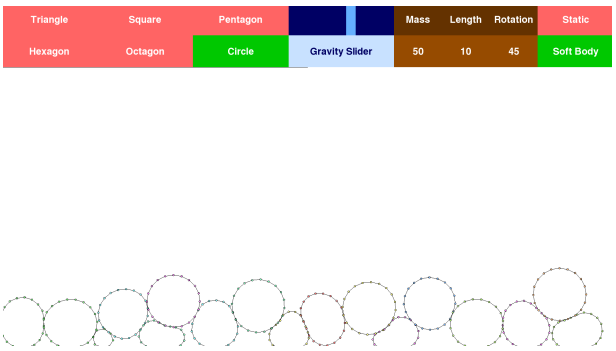
Example 2



Soft Bodies

Simulate soft bodies with flexible and dynamic behavior.

Example 1



Example 2