MujoCo Documentation and Guide for Project DACERI

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Overview

This document serves as a guide to using the MuJoCo simulation software, particularly as it applies to the DACERI project.

MuJoCo is an open-source physics engine owned by Google DeepMind. The software is designed for scientific purposes and is widely used for robotics simulation. MuJoCo loads .xml files in its native modeling format, MJCF.

For the purposes of this project, MuJoCo serves as a virtual testing environment to provide kinematic data and predict failure conditions, ultimately informing robot design decisions. The DACERI project then uses a Python script to load the models, interface with a game controller, and access MuJoCo simulation data for graphing. The .xml files for the robot utilize 3d models of various components for a more accurate simulation.

Tutorials

Getting Started:

1. For installation: https://mujoco.org/
2. Series of basic tutorials (YouTube): https://youtube.com/playlist?list=PLc7bpbeTIk760SRoSDHfqi07RHa0Yv-bx&si=e12Bf3rdntKjwAvK
3. XML reference: https://mujoco.readthedocs.io/en/stable/XMLreference.html#body-geom
4. GitHub: https://github.com/google-deepmind/mujoco

DACERI simulation:

1. Follow the README in the DACERI GitHub repository: https://github.com/JeffersonLab/daceri

How-To Guides/Troubleshooting

Importing 3d models (.stl):

Prior to <worldbody>:

```
  <asset>
      <mesh name="3D_MODEL_NAME" file="3D_MODEL.stl" />
  </asset>
```

To create body:

```
<body name="#D_MODEL" pos="0 0 0">
          <geom type="mesh" mesh="3D_MODEL_NAME" condim="3" friction="1 0.005 0.0001"
rgba="0.6 0.4 0.2 1" euler="90 135 0"/>
      </body>
```

Adjusting robot movement speed:

Modify the magnitude of the “limit” variable in simulate-robot.py

Inertial tensors:

Use diaginertia (Ixx, Iyy, Izz) for diagonal tensor, and “fullinertia” (Ixx, Iyy, Izz, Ixy, Ixz, Iyz) for full tensor (with MuJoCo versions 2.3+).

Mjpython:

Mac users: run simulate-robot.py from the terminal using the below command (example uses anaconda3)

/opt/anaconda3/bin/mjpython "FILE_PATH/simulate-robot.py"