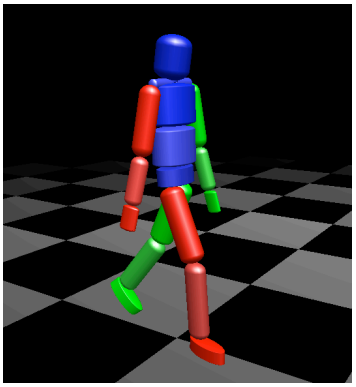
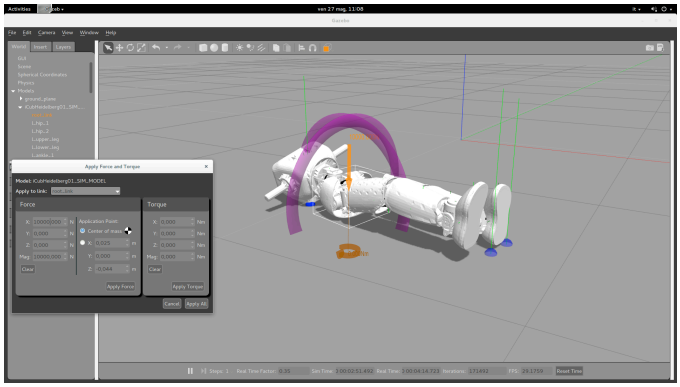
Master Thesis in Computer Science
"Dynamic Simulation of a Humanoid Model in Gazebo"



Visualization of „walker3D" in MeshUp



Dynamic simulation of „heiCub" in Gazebo.

Abstract

Bipedal walking is a unique form of locomotion and is both versatile and robust. A requirement for the analysis and optimal control of humanoid walking motion is a proper simulation tool. For the analysis and synthesis of human walking motions a detailed 3D model is available [1] for our kinematic visualization tool MeshUp [2]. The evaluation of the multi-body dynamics is done using RBDL [3]. However, much more is needed for a complete and realistic simulation, e.g. collision detection, impact and friction models. Simulation tools for this already exist and for application in robotics Gazebo [4] is successfully applied. Enabling a simulation in Gazebo for this model will allow a better verification of our optimal control approaches.

Project

The scope of the project is suitable for an advanced software practical or MSc thesis. The project involves:

- Converting MeshUp model from lua to URDF
- Creating proper meshes for collision detection
- Validating the simulation in Gazebo
- Writing a YARP-based module to allow online control of the model
- Simulation and comparison of different optimal walking motions
- Short paper/MSc thesis summarizing approaches and results

Requirements

- Good knowledge of and experience in C/C++ programming
- Programming experience in dynamic simulation or game physics is helpful
- Knowledge in optimal control is helpful
- BSc or compatible degree in computer science, mathematics or physics

References

[1] "An optimal control approach to reconstruct human gait dynamics from kinematic data", Felis et al, in IEEE-RAS Int. Conf. on Humanoid Robots, 2015

[2] https://bitbucket.org/MartinFelis/meshup

[3] „RBDL - an Efficient Rigid-Body Dynamics Library using Recursive Algorithms", Felis, M. L., Journal Autonomous Robots, 2015 (submitted)

[4] http://gazebosim.org/

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