



Whole Body Interface Toolbox (WBI-T): A Simulink Wrapper for Robot Whole Body Control

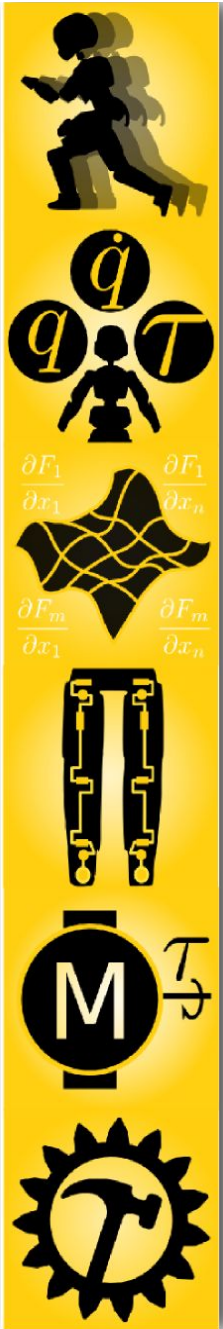
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Marco Randazzo, Francesco Nori

Istituto Italiano di Tecnologia.
Department of Robotics, Brain and Cognitive Sciences (RBCS)



Overview

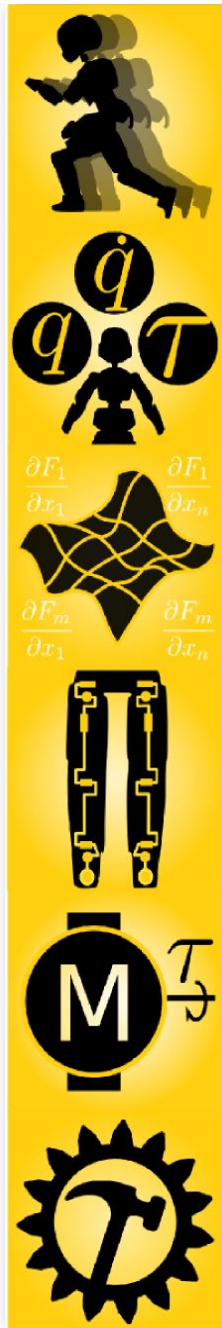
- Motivations
- Features and description
- Dependencies and System Requirements
- Whole Body Interface
- Implementing a controller (Demo)
- Working with the real platform



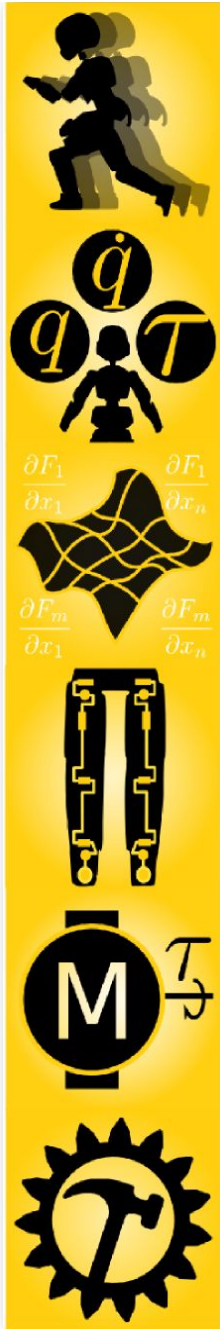
Under the Hood

The YARP Middleware

"It is a set of libraries, protocols, and tools to keep modules and devices cleanly decoupled. It is reluctant middleware, with no desire or expectation to be in control of your system"



Motivations



- "Rapid prototyping" of controllers.
- Better alternative to the use of YARP JAVA bindings
- Exploitation of **Simulink** and **MATLAB** toolboxes
- Higher level of **abstraction** for humanoid robot interfaces.
- Motivate non-programmers roboticists to approach the real platform.

Description & Features

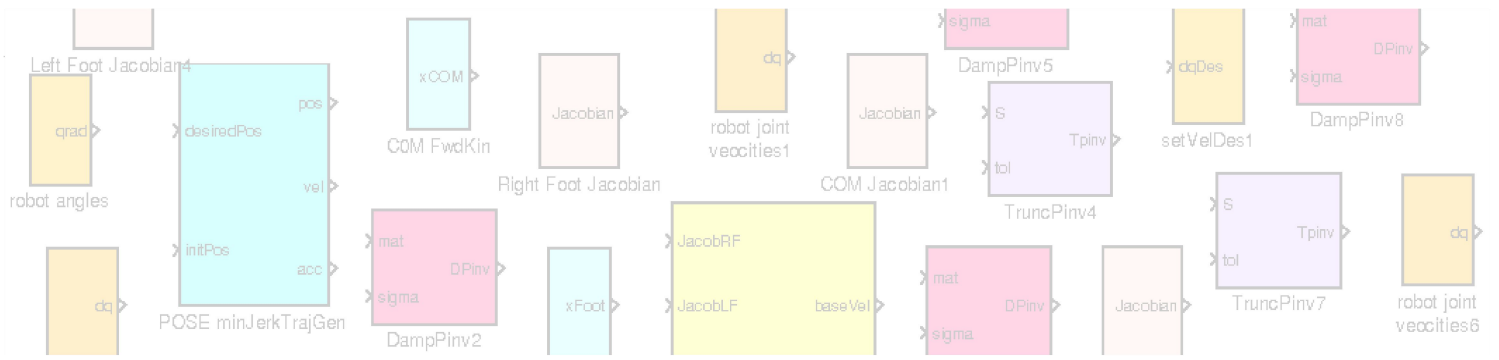
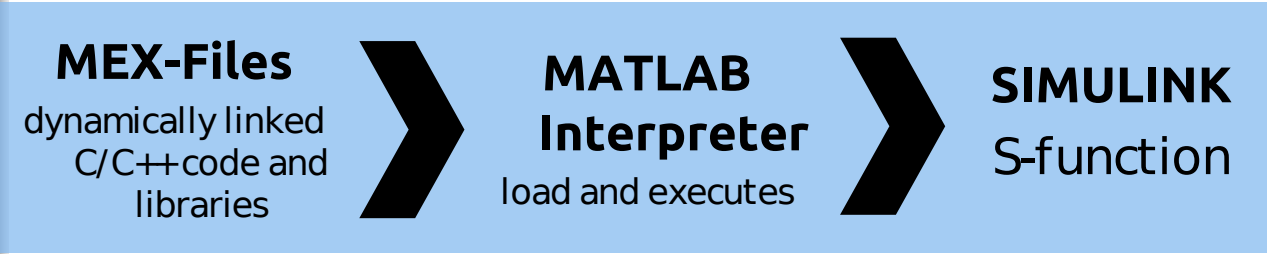
Simulink blocks wrapping a YARP-based implementation of the Whole-Body Interface (WBI) [1] C++ library. WBI acts as an abstraction layer for any interaction with the robot, making code robot-independent.

- Easy interface with YARP based humanoid robots.
- Instantaneous transfer of simulation results onto the real platform.
- Deals with both fixed and floating base humanoids.
- Synchronization with YARP! Important aspect in the design and use of controllers in simulation.
- Supported OS: Linux, Mac OS X, Windows.

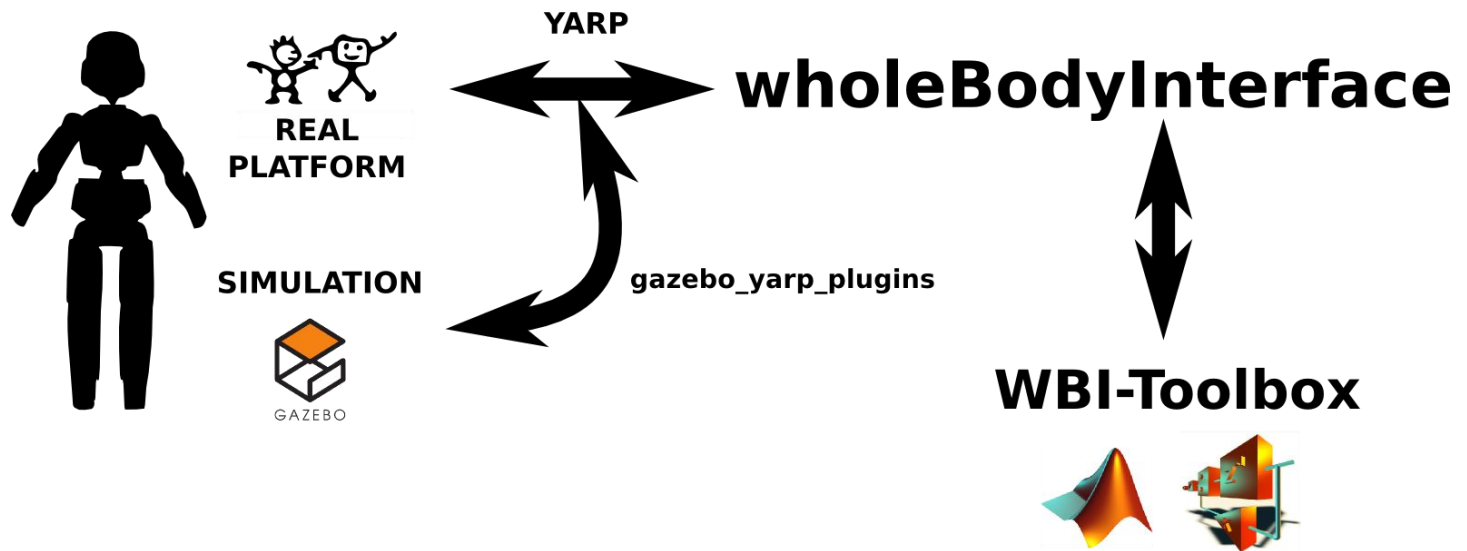
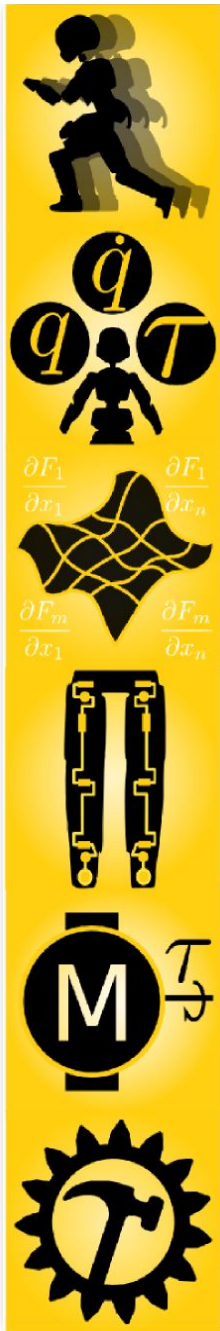
[1] Andrea Del Prete, Silvio Traversaro, and Marco Randazzo. Whole body interface. http://wiki.icub.org/codyco/dox/html/wbiy_8h_source.html , 2013.



Whole Body Interface Toolbox



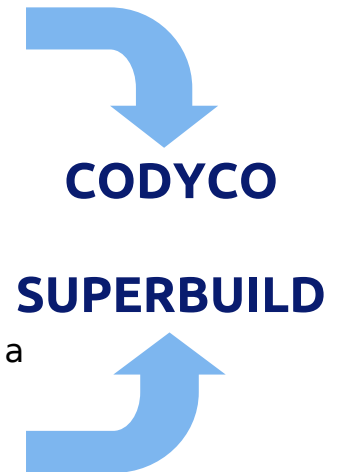
Whole Body Interface Toolbox



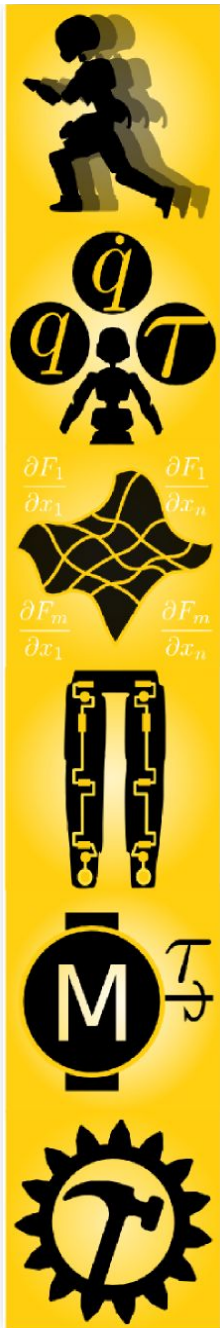
Dependencies and System Requirements



- **YARP** - Robotics middleware.
- **iCub Software** - Not strictly necessary
- **CoDyCo Software**
 - **iDynTree Library**
 - YARP based Robot dynamics library
 - **wholeBodyInterface Library**
 - Library defining a general interface for communicating with a floating-base rigid robot
- **Gazebo or iCubSim simulator.**



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RELIABLE!

FAST!

Under the Hood

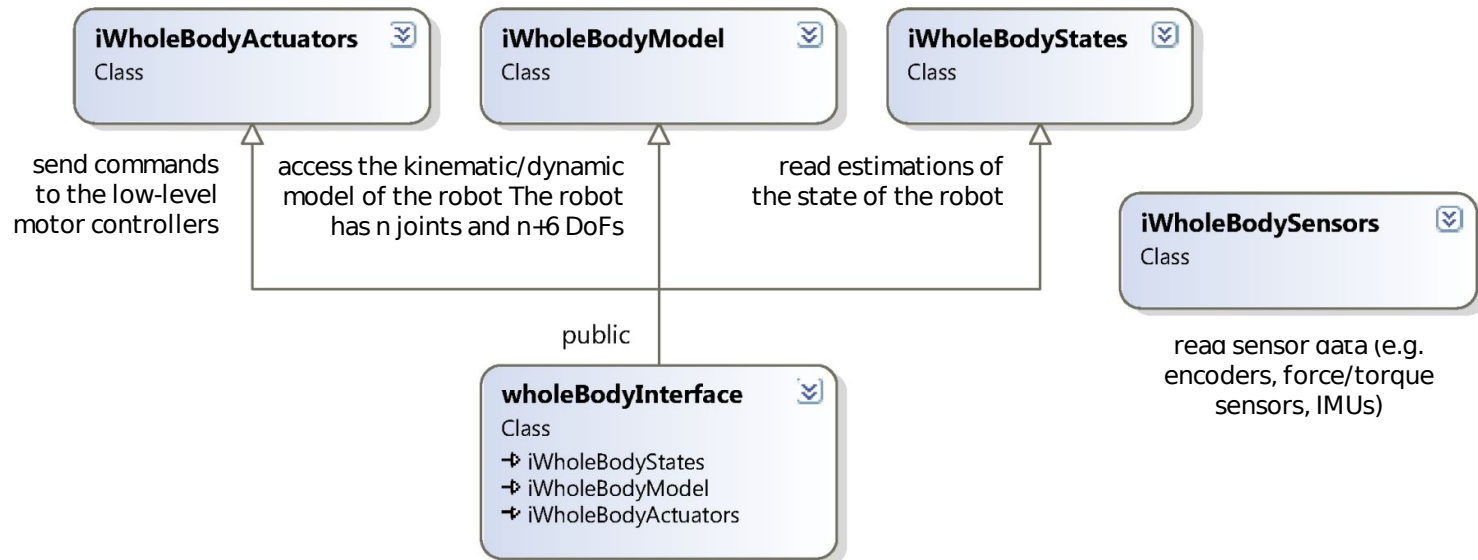
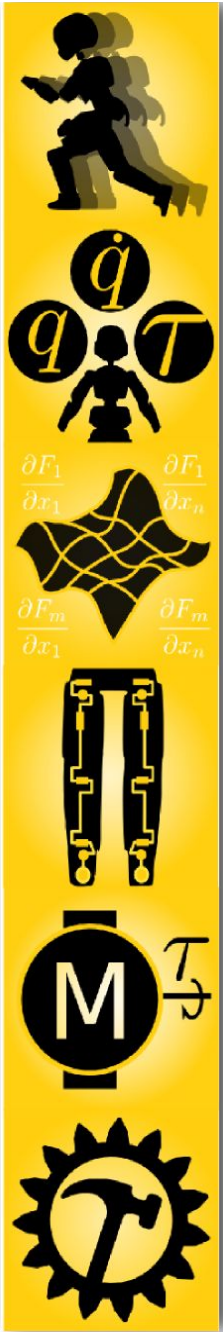
wholeBodyInterface Library

C++ template library defining a general interface for communicating with a floating-base rigid robot.




Under the Hood

wholeBodyInterface Library

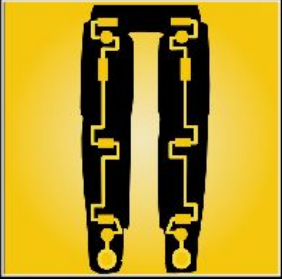


Implementing a Controller

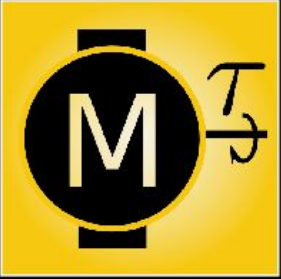





wholeBodyStates



wholeBodyModel



wholeBodyActuators



Utilities

WHOLE BODY INTERFACE TOOLBOX

Ολοκληρωμένο εργαλείο για τον έλεγχο και την ανάλυση της κίνησης του ανθρώπινου σώματος, με έμφαση στην αλληλεπίδραση με την τεχνολογία

This software was supported by the FP7 EU Project CoDyCO (No. 600716 ICT 2011.2.1 Cognitive Systems and Robotics (b))

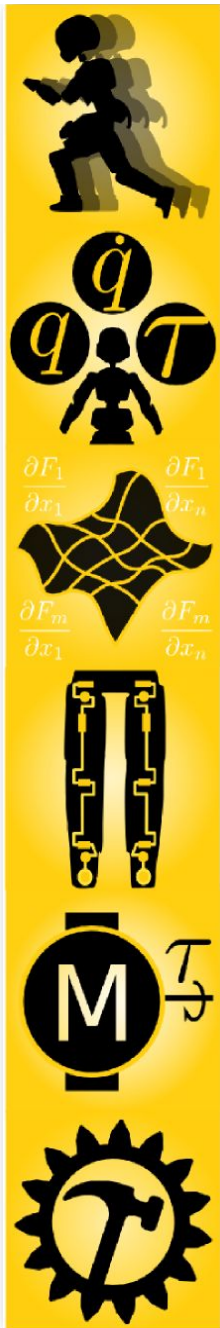
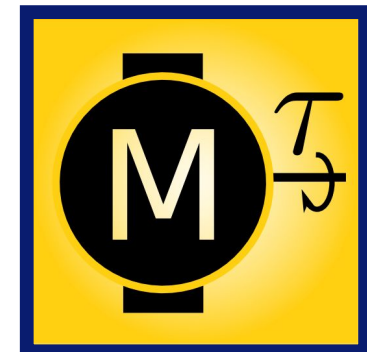
<http://www.codyco.eu>

Toolbox's main screen and subsections.

Implementing a Controller

Whole Body Impedance Controller quickly implemented on Matlab

$$-K_p(q_j - q_{j0}) - K_d\dot{q}_j + g = \tau_j$$





The Real Platform

The Whole Body Controller in the following video is being run on Simulink
http://www.youtube.com/watch?v=jaTEbCsFp_M

More Information



Installation instructions:

<http://github.com/robotology/codyco/tree/master/src/simulink>

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