

ROBOTIS-OP MATLAB Simulation and Middleware Codes for Motion Generation and Biped Walking

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<Abstract>

ROBOTIS-OP is one of the popular kid-sized humanoid robots produced by ROBOTIS. For motion generation of humanoid robots with such a complicated body structure, a simulator easy to install and to deal with is essential to both developers and users. MATLAB is in no doubt a standardized engineering simulator having been used so far worldwide, which can be quickly installed and executed on Windows OS. The author recently developed 3D MATLAB simulators running on its m-files for kinematics, dynamics, optimization (Particle Swarm Optimization), motion generation, biped walking, etc. The simulator has several options concerning motion types, animation style, and data to be depicted. The salient advantage of MATLAB as a simulation language is that one can directly analyze some problems occurred during simulation by plotting the relevant data inside the developing environment solely. Since, however, it is difficult to apply physics engines and realistic 3D graphic visualization tools to MATLAB compared with such a high-performance ROS-based 3D simulator as Gazebo, a further work incorporating the MATLAB codes into ROS packages is to be carried out.

For implementation of motion and walking with a real humanoid robot, the MATLAB simulator codes are converted in C++ format and installed in ROBOTIS-OP using libraries and functions for a main controller and DYNAMIXEL actuators of ROBOTIS. As we had witnessed in DRC Final, simulators have inevitable limitation in describing unstructured environment and/or coping with unpredicted events occurring in the real working space. The author succeeded in implementing simple motions including biped walking on an inclined floor by adjusting joint trajectories generated by the MATLAB simulator based on sensory reflex control using IMU and FSR sensors equipped in ROBOTIS-OP. The package name of middleware codes for ROBOTIS-OP is optWalk and a Korean book explaining the code contents with relevant basic principles is to be published soon. For future collaboration with the humanoid robot engineers in the world, the optWalk package will be revised to be fitted to ROS environment and the abundant packages.