Dribbel — Realisation of an energy efficient walking robot using power-port based modeling techniques

Edwin Dertien
Control Laboratory
Faculty of EE-Math-CS
University of Twente
The Netherlands
Email: e.c.dertien@ewi.utwente.nl

Gijs van Oort
Control Laboratory
Faculty of EE-Math-CS
University of Twente
The Netherlands
Email: g.vanoort@ewi.utwente.nl

Stefano Stramigioli
Control Laboratory
Faculty of EE-Math-CS
University of Twente
The Netherlands
Email: s.stramigioli@ieee.org

***Abstract*— In this video the walking robot 'Dribbel' is presented, which has been built at the Control Engineering group of the University of Twente, the Netherlands. This robot has been designed with a focus on minimal energy consumption, using a passive dynamic approach. It is a so-called *four-legged 2D walker*; the use of four legs prevents it from falling sideways.**

During the design phase extensive use has been made of *20-sim*. This power port based modeling package was used to simulate the dynamic behaviour of the robot in order to estimate the design parameters for the prototype. The parameters obtained by the simulation were then used as a basis for the real robot.

The real robot is made of aluminum and weighs 9.5 kg. Each of the nine joints (one hip, four knees, four feet) has a dedicated electronic driver board for interfacing the joint sensors.

For walking a simple control loop is used: when the front feet touch the ground, the rear legs are swung forward. The control parameters can be adjusted online using a serial link. Using this simple control loop, the robot walks at a speed of 1.2 km/h and a step frequency of 1.1 Hz. The hip actuator consumes 6.7 W. The walking behaviour of the robot is very similar to the simulation, regarding both walking motion and power consumption.

With the serial link real time data acquisition in the simulation package (running on the PC) is possible. This allows for advanced verification and fine tuning of the control algorithm. The simulation package can also be used directly within the control loop.

Future research is planned on energy based control of the walking motion, using impedance control for the hip actuator and design of more advanced (and actuated) foot shapes.