

Research Topic for the Arts et Métiers ParisTech - CSC PhD Program

Subfield: Electrical Engineering

ParisTech School: SMI 423

Title: Control of an 8-links humanoid robot used for dynamic walking.

Advisor(s): Prof. Gabriel Abba, gabriel.abba@ensam.eu website: www.lcfc.fr

Short description of possible research topics for a PhD:

Control of humanoid robots is a complicated task while there are a high number of solutions for the realization of each articulation and many degrees of freedom (DOF). The optimization of the robot trajectories has a very significant impact on the design of the joint and on the control (see references). Recently, dynamic walking methods have been proposed (see Chen thesis) with the addition of springs on the hip joints. It is also interesting to verify this approach on real robot such HOAP or HRP4. The tasks and the tests can then be used of upgrade the design and the performance of such type of robots.

Required background of the student: Master in Electrical Engineering (automatic control, robotics).

2-3 representative publications of the group:

Grizzle J.W., G. Abba, F. Plestan (2001), Asymptotically Stable Walking for Biped Robots: Analysis via Systems with Impulse Effects. *IEEE Trans. Automatic Control*, 46(1):51-64, January 2001. This paper received the 2002 George S. Axelby Award for the Best Paper in the IEEE Trans. Automatic Control during the years 2000 and 2001.

Chevallereau C., G. Abba, Y. Aoustin, F. Plestan, E.R. Westervelt, C. Canudas de Wit, J.W. Grizzle, (2003), RABBIT: A Testbed for Advanced Control Theory. *IEEE Control System Magazine*, 23(5):57-79, October 2003.

Chevallereau C., G. Bessonnet, G. Abba, Y. Aoustin (2009) *Bipedal robots: modeling, design and walking synthesis*. Wiley ISTE Eds., New York, Control systems, Robotics and Manufacturing Series.

Chen Z., Optimized Walking of an 8-link 3D Bipedal Robot, Ph.D. dissertation, Arts et Métiers, ParisTech (ENSAM), Metz, France, October 2015

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