

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

Subfield: Electrical Engineering

ParisTech School: SMI 423

Title: Robot control with multi-sensor measurements and robust based control laws.

Advisor(s): Prof. Gabriel Abba, gabriel.abba@ensam.eu website: www.lcfc.fr ou <http://www.corouso.sitew.com/>

Short description of possible research topics for a PhD:

Production or manufacturing processes are very important at the industrial level. Industrial robot controllers are developed for handling tasks or free trajectories in space. When the task requires strong interactions with the robot environment, for example for the shaping of materials, grinding or the friction stir welding, the interaction forces deform the robot. Under these conditions the geometric model can no longer know the exact position of the tool. One solution is to set tooling external sensors, such as cameras or profilometers. Additional sensors such as accelerometers can detect the resonance frequency and high-frequency variations of the tool position. We are in a multi-sensor environment with time constraints and different availability. In this context, the command must offer solutions for improving the dynamic behavior of the robot during application.

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

2-3 representative publications of the group:

J. Qin, "Robust hybrid position/force control of a manipulator used in machining and/or in friction stir welding," Ph.D. dissertation, Arts et Métiers, ParisTech (ENSAM), Metz, France, 2013, in French.

J. Qin, F. Léonard, and G. Abba, "Nonlinear discrete observer for flexibility compensation of industrial robots," in *The 19th World Congress of the International Federation of Automatic Control*, Cape Town, South Africa, August 2014, pp. 5598–5604.

S. Zimmer, L. Langlois, J. Laye, and R. Bigot, "Experimental investigation of the influence of the fsw plunge processing parameters on the maximum generated force and torque," *International Journal of Advanced Manufacturing Technology*, vol. 47, no. 1-4, pp. 201–215, 2010.

K. Wang, F. Léonard, and G. Abba, Dynamic Model Identification of Axial Force in Robotic Friction Stir Welding, INCOM 2015, Proc. of 15th IFAC/IEEE/IFIP/IFORS Symposium on Information Control Problems in Manufacturing, Ottawa, Canada, May 11-13, 2015, Vol. 48, Issue 3, pp. 1936-1941.

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