

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

Subfield: Electrical Engineering

ParisTech Doctoral School: SMI 423

Title: Cobot control with ergonomic interactions for assistive tasks.

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

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. However, some tasks are difficult to achieve with a robot and remaining in fact provided by the operators. Operators handle heavy loads or average charges for a human but with significant rates. In the long term, these operators are developing musculoskeletal disorders. Exoskeletons have been developed to facilitate these constraining operations. Unfortunately, these exoskeleton devices are not easily accepted by operators. The objective of this project is to propose solutions based on the control of industrial robots using an ergonomic interface. The operators handle the ergonomic interface and are thus discharged from the weight of the load to be handled. Via the interface, the operator remains the master of work organization, control the robot and monitoring of the safety of the installation. The operator also ensures adaptability workstation and launches sequentially succession of tasks. The objective of this research topic is to change the controller of the current industrial robots to make it safer for operators and improve the use of the robot on the workstation for the operator's work is facilitated.

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

2-3 representative publications of the group:

Qin J., F. Leonard and G. Abba, Real-time trajectory compensation in robotic friction stir welding using state estimators, *IEEE Transactions on Control System Technologies*, accepted December 2015, on-line.

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.

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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