ParisTech

Arts et Métiers Sciences et Technologies

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM
(one page maximum)

Field: Materials Science, Mechanics, Fluids

Subfield: Mech. Engineering / Automatic control

Title: Trajectory shaping for vibration reduction of a class of non-linear non-minimum phase systems

ParisTech School: Arts et Métiers Sciences et Technologies

Advisor(s) Name: Olivier Thomas; Richard Béarée
Advisor(s) Email: olivier.thomas@ensam.eu; richard.bearee@ensam.eu
Research group/Lab: LISPEN
Lab location: Lille
(Lab/Advisor website): https://lispen.ensam.eu/

Short description of possible research topics for a PhD:
Compared with conventional high-stiffness structure used in robotics, the design of lightweight robots has a lot of new potential, e.g. for safe human-robot interaction (HRI) or for energy efficiency. Such mechanical structure with low stiffness faces challenges for accurate tracking of the end-effector motion. Indeed, motion-induced vibrations may exhibit sensitive non-linear and non-minimum phase phenomena. This study proposes to investigate both in theory and practice a) the modelling (reduced order non-linear lumped model) and identification stages of these phenomena and b) the adaptation of the trajectory shaping stage for the reduction of the motion-induced deformations and vibrations.

Required background of the student:
Mechanical engineering; vibration analysis; automatic control

A list of 5 (max.) representative publications of the group:
1. Besset, P., Béarée, R. (2017). FIR filter-based online jerk-constrained trajectory generation. Control Engineering Practice, 66, 169-180.
2. Béarée, R. (2014). New Damped-Jerk trajectory for vibration reduction. Control Engineering Practice, 28, 112–120.
3. Cottanceau, E., Thomas, O., Véron, P., Alochet, M., and Deligny. R. (2017). A finite element/quaternion/asymptotic numericalmethod for the 3D simulation of flexible cables. Finite Elements in Analysis and Design, 139 :14–34.
4. Thomas, O., Sénéchal, A., and Deü, J.F. (2016). Hardening/softening behaviour and reduced order modelling of nonlinear vibrations of rotating cantilever beams. Nonlinear dynamics, 86(2) :1293–1318.