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TUTORIAL

Advanced control and noises reduction for micromanipulation

Monday, July 7th, 2014

Web: http://sites.femto-st.fr/tutoAIM14/

Abstract:
This tutorial aims to provide courses, lectures and practical exercises on advanced control and noises reduction for micromanipulation. The realization of microbotic tasks in such application requires the achievement of highly severe performances of positioning like very high accuracy, low noises, large bandwidth.... Indeed, the more the dimensions of the manipulated objects are small, the more the expected performances should be severe. The proposed tutorial includes the modeling, the control and the signal measurement/estimation in microrobots, end-effectors of microrobots, actuated micromanipulators and microgrippers utilized in micromanipulation but also in other applications. In order to success the tasks, these modeling, control and measurement/estimation should consider the nonlinearities, the noises, the vibrations, the uncertainties and the disturbances that typify the actuators, the working environment and the micro-nano-scales in general. Additionally to these characteristics, the lack of convenient sensors at these scales put additional challenges to the signals estimation and to the controllers design for the systems.

The tutorial provides an introduction to the advanced and recent techniques devoted to control the systems for micromanipulation tasks. Both theory and practical aspects are proposed. For this aim, the tutorial is a full day with the first part devoted to the theory (lectures) and the second part devoted to demonstrations and labs.

Organizers:
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Presenters:
Mokrane Boudaoud, ISIR, UPMC
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Philippe Lutz, FEMTO-ST, UFC
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Program:
The presenters of this tutorial will provide self-contained notes on recent works concerning the topics they present

The first part of the tutorial (morning) is a set of courses/lectures:

- Robust Control and Gain Scheduling of microsystems (Y. Le Gorrec, M. Boudaoud).
- Interval Modeling and Control Techniques of piezoelectric microsystems (P. Lutz).
- Noise Analysis, Modeling and Filtering at the Micro/Nano-Scales (Y. Haddab).
- Open loop control of piezoelectric microsystems (M. Rakotondrabe).
- Self sensing measurement techniques and advanced observers in piezoelectric microsystems (P. Lutz, M. Rakotondrabe).

The second part of the tutorial (afternoon) is devoted to labs and demonstrations:

- Control of a silicon microgripper and noise filtering (M. Boudaoud).
- Open-loop control of a piezoelectric actuator taking into account hysteresis, creep and vibrations (D. Habineza).
- Interval control (M. Rakotondrabe)
- Self sensing (P. Lutz)

Audiences:
The tutorial is intented to senior researchers, Ph.D students, Post-Doc and engineers working in the micro/nano world in general, especially the ones who have needs in micromanipulation applications.