Postdoctoral position:

Microfabricated Multi-Degrees-Of-Freedom Actuated and Sensorized Cartesian Platform for Nanoscale Characterization

Keywords: design, modeling, control, microscale, microfabrication, instrumented platform, sensor, actuator, compliance,

- Scientific and Technical skills: microfabrication, design, instrumentation, experimentation, control,
- Training/experience: PhD in mechatronics, Microsystems, automatic control, instrumentation
- Contract: 12 months
- Starting: September/October 2012
- Place: FEMTO-ST Research Institute, AS2M (Automatic Control and Micromechatronic systems)
- Salary: Salary scale, depending on the candidate’s experience

Framework:
The AS2M department of FEMTO-ST Institute manages research activities in the fields of microrobotics, micro-actuation, automatic control and micro-assembly for more than 15 years (Fig. 1). Several micro-assembly platforms have notably been developed (Fig. 1-b) allowing the assembly of components smaller than some tens of micrometers. Today, the department is internationally recognized and among the top world reference research group within this field.

Despite numerous works done, achieving controlled micro-assembly tasks still remains extremely challenging (limitations of vision based control, components fragility, complex trajectory to control with extremely good accuracy…). One of the most challenging topic relies in the integration of sensors able to measure micromanipulation forces (some tens to some hundreds of microNewtons) in order to control them (Fig 1-c).

In addition to the control of gripping forces (forces happening between the microgripper and the handled microcomponent), contact forces (between the component and the support platform or between 2 components to assemble) must also be controlled. For that, a platform integrating actuators and sensors has to be designed and fabricated.

![Fig1](a) (b) (c)

Fig1: (a) Example of assembled Optical Microsystem (b) Robotic micro-assembly platform comprising 9 degrees of freedom (nanopositionning), a 4 degrees of freedom microgripper, 3 high magnification cameras, a vacuum gripper and a laser sensor (c) millimetric, 2 degrees of freedom, sensorized platform.

Context and objectives of the works:

Proposed works lie in the MYMESYS\(^1\) project (French National Research Agency) whose main objectives consist in studying and developing several complementary (in terms of range, sensibility, bandwidth) of several multi-DOF

\(^{1}\) “High Performances Embedded Measurement Systems for multiDegrees of Freedom Microsystems”

http://www.femto-st.fr/mymesys/
(Degrees-Of-Freedom) sensing principles for microscale applications (self-sensing based on piezo components, magnetic, piezoresistive. The recruited post doc will work within Task5 of this project which deals with the design, fabrication and characterization of an instrumented Cartesian platform for sensors calibration (sensors studied within the other tasks of the project). Interactions between the recruited fellow and members of the department will be a key point due to generic interests, sharing of competencies and experience....

Works:

This instrumented platform to be developed will be based on compliant design with integrated sensors and actuators. It will enable the measurement of forces or displacements along several directions with nanometer or microNewton resolutions. For several reasons (limited space, signal/noise ratio…) the platform will have to be small and integrated, requiring the use of clean-room microfabrication techniques.

Several steps will have to be achieved:

- Choice of the actuation principle, sensing principle regarding state of the art, department competencies and clean room possibilities,
- Design, fabrication and characterization of constitutive elements for sensors and actuators principle and performances validation,
- Design of the compliant structure including static and dynamic aspects, definition of actuators and sensors locations,
- Microfabrication of the actuated and sensorized Cartesian platform,
- Setting up of an experimental benchmark for the characterization of the performances of the platform (force and position, static and dynamic point of view)

Job details:

To carry out these works, we are looking for a motivated PhD m/f, loving the discovery of new issues and seeking to acquire key skills in the areas of micromechanics, microtechnologies, mechatronics, instrumentation and automatic control.

The project being scientific, applicants’ skills such as logic, rigor, dynamism, autonomy and of course the imagination will be useful. The ability to work within a project team at the front of global technology will be crucial.

Contact, application:

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