Last edition: 2013-06-12

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SPECIMeN Group

Sensing strategies, Perception and Characterization at Micro- and Nano-scales

AS2M Dep^{t} – Automatic Control and Micro-Mechatronic Systems

http://www.femto-st.fr/fr/Departements-de-recherche/AS2M/Accueil/

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Outline for AS2M scientific meeting (2015/6/4)

Part 1: annual activity report of the SPECIMeN team

Part 2: a survey of data-based approximate linearization by feedback using chimera inputs compensation

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Part 1: annual activity report of the SPECIMeN team

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AS2M dep^{t} multi-disciplinary research fields:

- **Automatic control,**
- **Robotics,**
- **Mechatronics,**
- **Industrial engineering.**

AS2M dep^{t} research axes:

- **Micro-robotics** (micro-manipulation & assembly, characterization and biomedical appl.),
- **Control of systems at the micro-scale** (micro-robots, micro-actuators, micro-systems),
- **Prognostics & Health Management** (industrial and biological systems).

AS2M dep^{t} research groups: **SPECIMeN, CODE, MiNaRoB, PHM.**

SPECIMeN group framework: **Study, development and use of perception processes and associated information processing methods to optimize the implementation and the performances of mechatronics systems operating at micro- and nano-scales.**

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SPECIMeN staff

Permanents

- Nadine Piat (PR)
- Sounkalo Dembelé (MCF HDR)
- Emmanuel Piat (MCF HDR)

Shared manpower resources

- Patrick Rougeot (IR)
- Joël Abadie (IR)
- Joël Agnus (IR)

MiNaRoB (2016)

m = 49.6 years, σ = 5.6 years

		Supervisors
PhDs	• Margot Billot (A3-)	EP, JAg + P. Stempflé (MN2S)
	• Racha Gana (A2)	EP, JAb + C. Pieralli + B. Wacogne (Optique)
	• Andrey Kudryavtsev (A1)	SD, NP
With CODE	• Valérian Guelpa	GL, NP
Internships	• Chloé Jeannin (4 months)	JAb, EP, B. Wacogne (Optique)

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Small team ⇨ focused issues (mandatory !)

Sensing strategies, perception and characterization at micro- and nano-scales mainly using force sensors and SEM imaging.

Scientific issues divided into two research topics:

- **Development of sensors operating at micro- and nano-scales**
- **Exploitation of sensors providing information from micro- and nano-scales**

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Funded projects

MEMS-Nanotrib (Labex ACTION) — Ends march 2016
MICROBE (Région FC) — **Ends now** (eventual prolongation of functioning funding)
SEMSAW2 (BQR)

Andrey Kudryavtsev thesis (3D reconstruction in SEM) not associated to a funded project

A absolute need to obtain new funded projects

Classical SPECIMeN scopes

- **Sensors design**
- **Sensors modeling and calibration, sensing quality estimation**
- **Defects and disturbances characterization and correction**
- **Micro-objects characterization at micro-nano-scales**
- **Multi-scale sensing strategies, nanoworld imaging & reconstruction**

New projects (work in progress)

H2020 program: Interreg France - Suisse
CITHaDel: Cellules Intégrées de mesure de microforce par Technologie HybriDE

FEMTO-ST (ENSMM,UFC), Percipio Robotics SA, Alemnis GMBH, EMPA
3 years

Total cost FR + CH: 1,34 M€
Total cost FR: 966 k€
FEDER funding for ENSMM: 354 k€
FEDER funding for UFC: 54 k€

WP2: continuation of MEMS-Nanotrib
LABEX project with higher TRL

EMPIR program: European Metrology Program for Innovation and Research
5 NMI (France, Germany, Switzerland, Austria, Denmark), FEMTO-ST, Alemnis GMBH

Potential Research Topic (PRT) submitted:
Instrumentation for Measurement and Traceability of Small Forces

Waiting for the Selected Research Topics (SRT)

Current research axis

Force sensors developments

Multimodal characterization of human oocytes: Racha thesis

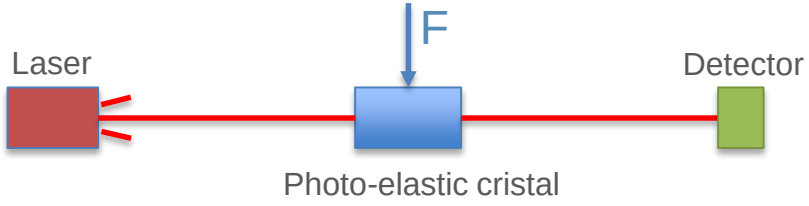
- Mechanical modeling of oocytes during force loading / unloading
- Nanoforce sensor in liquid env^{t} using unstable magnetic spring
- Spectral characterization of oocytes

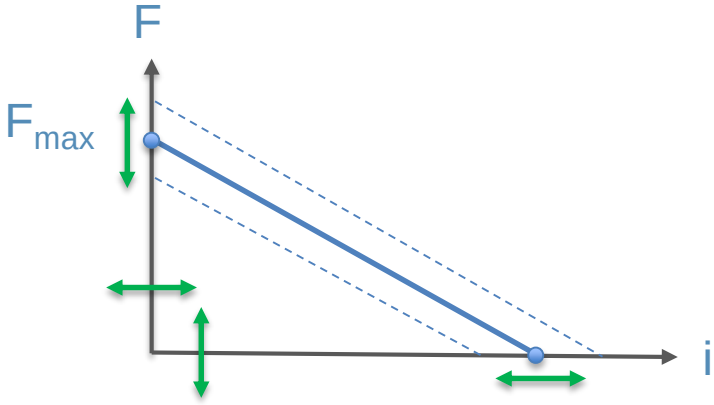
MultiDOF piezoresistive MEMS force sensor: presentation of Margot

Environmental disturbances compensation and force sensor traceability

Model-free external mechanical disturbances compensation using differential magnetic springs for nanoforce sensing: presentation of Margot

Photo-elastic Nd-YAG cristal loading using traceable electro-diamagnetic force actuator: Julie Beluche first year project





Current research axis

Observers synthesis and environment disturbances evaluation / compensation

Data-based approximate linearization by feedback using chimera inputs compensation: see part II

Nanovision in SEM

3D-Structure from motion in SEM (with auto calibration) : presentation of Andrey

Future research axis

Towards force traceability between 1µN and 500 µN

Enhancement of Force measurements below 1 µN (environmental disturbances compensation)

Oocytes maturity diagnostic

MultiDOF MEMS force sensor for nanotribology

Multisensor fusion for 3D nanovision in SEM (SE1, SE2, BSE detectors)

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Part 2: a survey of data-based approximate linearization by feedback using chimera inputs compensation

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