

Call-for-Papers

A Special Issue of MECHATRONICS supported by the European Society for Precision Engineering on Thermal Effects in Mechatronic Systems

1. Motivation

Achieving high precision operation of Mechatronic Systems does require stable and reliable control of position and motion. For good performance the influence of thermal disturbances on the stability of the metrology loop must be accounted for with utmost care. In machine tools the heat generated by the driving motors and the processes lead to deformations that reduce the accuracy. In this case deformations might be as large as 100 μm .

In semiconductor lithography tools, extreme attention must be given to thermal conditioning and control in order to achieve the required overlay precision, which is typical in the order of several nanometer of latest generation tools. In tools for nano science, thermal drift on a nanometer scale might already make an application useless. For instance, in the latest generation of Transmission Electron Microscopes, sub angstrom imaging resolution can only be achieved with corresponding small drift rates.

In applications like the examples given here, the manipulation of different parts is generally done by means of active control. The precision is determined by the strong interaction between metrology system, controller, actuators and motion devices in the Mechatronic System. The thermal issues therefore are of major importance to Mechatronic Systems. Nevertheless, thermal effects do not get much attention in research in the areas of modeling and control of Mechatronic Systems, unlike e.g. dynamics.

In this issue of **Mechatronics** it is intended to bring together contributions from authors that have been active in the field of thermal aspects to share their experiences and research results. The guest editors have been involved in a Special Interest Group on “Thermal Effects in Precision Systems” set up by the European Society for Precision Engineering and Nanotechnology (**Euspen**). This organization is supporting the realization of this special issue.

2. Objectives

The aim of this special issue is to bring together researchers and practitioners in the field of controlling the thermal effects on Mechatronic Systems.

3. Topics of Coverage

Papers are sought from mechanical engineering, control systems, electrical and electronics engineering, signal processing, mathematics, physics and other relevant disciplines. Relevant application areas are expected to be machine tool industry, metrology instruments, space instruments, semiconductor manufacturing and many others.

Topics will include, but are not limited to (categorization not mandatory):

1. Modeling tools to predict and/or compensate for the thermal effects in systems
 - Model reduction
 - Model validation
 - Error compensation algorithms
2. Active control of the thermal state of a system and its environment
 - Advanced control algorithms for thermal systems
 - Identification of thermal systems for control
 - Use of multiple sensor inputs (sensor fusion)

- Thermal actuator design
- 3. Measurement methods to determine the thermal state of systems
 - Fast and accurate temperature sensing (milli Kelvin)
 - Accurate temperature calibration methodologies
 - Reconstruction of thermal state from sensor information
 - Sensor location optimization
 - Determination of thermal coefficients in vacuum systems
- 4. Design of mechanical structures with reduced thermal sensitivity
 - Inherent stable design
 - Controlling conductivity and insulation
 - Thermal design methodologies for non standard ambient conditions (e.g. vacuum, cryogenic)

4. Composition and Review Procedures

All manuscripts should follow the general guidelines for authors of Mechatronics, which can be found at <http://ees.elsevier.com/mech/>.

Manuscripts should not have been published or be under consideration at other journals.

5. Timeframe

The timetable for the special issue is:

30 Apr 2010 due date for papers submission

30 Jun 2010 reviews completed; and decisions sent

30 Sep 2010 revised manuscripts due

30 Nov 2010 final reviews complete, make decisions on acceptance

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