

MSc assignment

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Project	-	
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ABOUT MI-PARTNERS

MI-Partners is a company specialized in the development of high-end mechatronic systems (e.g. products, production equipment, test/measurement setups). These systems are often very challenging in terms of positioning accuracy and speed. To perform the full trajectory of system design: starting from white board and specifications, we generate concepts and evaluate these concepts for further optimisation and selection. The evaluation and optimisation are iterative processes, where modelling for performance prediction and mechanical design go hand in hand. We outsource the manufacturing of the parts, but assembly and testing we do in-house. As we are mostly working on new systems with demanding performances, such as prototypes, test equipment or research equipment, we always face unique challenges. Our company is formed by about 40 highly educated and skilled engineers and located in Veldhoven. MI-Partners' main competences being mechatronic system design, precision engineering, thermal design, dynamics and control. Renown customers from all over the world acknowledge our added value, such as ASM Pacific Technologies, Carl Zeiss, several national research labs, but also Dutch companies like ASML, Philips and NXP.

Given the complex nature of our assignments, we are looking for above par students who are ready to take on a challenge in an industrial environment. The research proposals are based on experiences with projects, so you will be working on relevant topics. You are responsible for your work, but since we value the outcome, we are committed to providing the support needed to make your assignment a success.

INTRODUCTION ASSIGNMENT

Errors induced by thermal deformations, i.e. deformations of metrology structures or deformations/displacements of critical components, due to temperature fluctuations, are becoming one of the most significant contributors to the overall accuracy budget of high precision equipment.

Since measuring the position of the point of interest (POI), and using this information in position feedback control loops, is in many systems not possible, additional position information must be derived alternatively. One way is to use a thermal-mechanical model of the system and use temperature sensor to estimate the POI position. These deformation estimates can then be used in correction methods and thus increase the systems accuracy.

To make this approach successful, the sensor locations much be chosen correctly and the model used must be able to accurately describe the system behaviour. On the other hand, the model size must be limited to prevent the analyses from becoming computationally very expensive and thus time intensive. In order to accelerate this process, while retaining accurate models, model reduction techniques are used in practice.

ASSIGNMENT DESCRIPTION

The assignment focusses on the following elements:

- Literature study in which the current state-of-art model reduction techniques are investigated, together with optimal approaches w.r.t. sensor placement
- Comparison of selected techniques on the basis of an example
- Full elaboration of the most promising technique
- Implementation of a model on a realistic use case