ATC: New results on FRF identification for thermal & beyond

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ADVANCED THERMAL CONTROL CONSORTIUM

Description of poster

Advanced Identification & Control for Thermal Systems

Motivation

In recent years, several industrial parties have identified the need for further development of the thermal control competence. Progress in motion control has led to substantial improvements in accuracy and throughput has been one of the main research subjects within the mechatronics community. However, due to the advancements in position control thermally induced deformations are no longer negligible in the full system performance. Indeed, cases in the precision manufacturing industry, lithography industry and electron microscopy industry have illustrated the need for improved thermal management.

Research directions

The current project focusses on bringing thermal identification and active control to an advanced level as motion control [1].

Advanced Identification

The wide selection of existing literature on system identification for mechanical systems are re-evaluated and a new tailor made approach for thermal systems will be devised. It is expected that the research follows along the lines of, e.g., [2].

Advanced Control

Similarly to system identification, the feedback control literature is often focused on position control. Special considerations apply for thermal systems, and although the systems are first order with no resonance phenomena the control systems are non-trivial. Special interest in deformation control, and connecting mechanical and thermal control systems [3].

Next big step: new FRF identification

This poster presents the first results from the current research direction, non-parametric identification. It illustrates the need for transient data removal in frequency response function measurements. And it presents the concept of Local Parametric Methods that explicitly estimate and remove this transient using the new result [4].

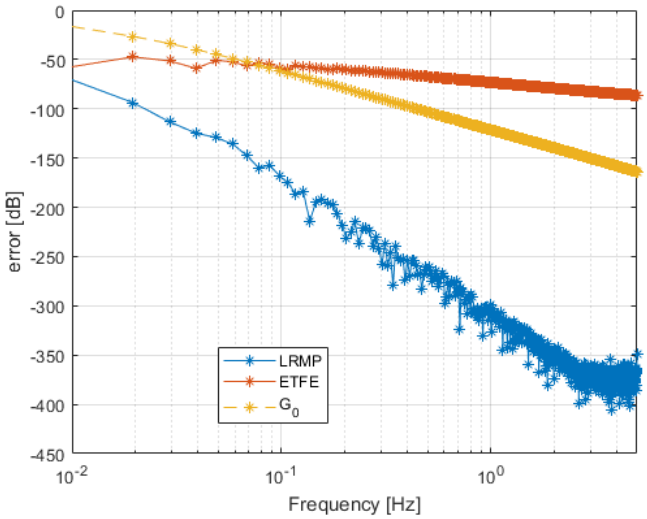

Figure 1 Estimation error of proposed method (LRMP) and classical method (ETFE) applied to a 1D thermal system. Significant error reduction is achieved by estimating and removing transient components. True plant is shown as G_0.

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