VRIJE UNIVERSITEIT BRUSSEL-FACULTY OF ENGINEERING

Proposal PhD Jury Composition

Keep in mind that the guidance committee may not form the majority of the votes in the doctoral jury and in principle de jury should contain at least two persons of the other gender. The jury should contain at least 3 VUB ZAP members[1].

PHD STUDENT	
Last Name, First Name	Quintana Carapia, Gustavo
Department	ELEC
Title PhD Thesis	Validation of data-driven dynamic measurements methods
Enrollment	PhD in Engineering Sciences

JURY	
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Secretary of the Jury	dr. ir. Dreesen, Philippe (VUB, ELEC) philippe.dreesen@vub.be
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Remarks	

PARTNERINSTELLINGEN	
Cotutelle	NO
Collaboration with research institution	NO
Partner or research institution	

ASTRACT (MAX. 1/2 A4)

Sensors are dynamical systems and the physical quantity is the input excitation. To have fast measurements, the input must be estimated during the sensor transient state. Otherwise, users have to wait for the sensor steady state when the response is proportional to the input through the sensor static gain. One approach to get fast input estimation is filtering the sensor transient response with another dynamical system aiming to reconstruct the input and to compensate the estimation time. Another approach is processing the transient response on a digital signal processor (DSP). Compensators are model based and DSPs allow model free methods that can reduce the estimation time.

There exists a model-free method that directly estimates the step input level from the sensor step response. This method was formulated as a Hankel structured errors-in-variables (EIV) problem where the regression matrix and the regressor are correlated. The structured EIV problem is solved with recursive least-squares to allow real-time implementation. The range of application of this step input estimation method is wide because it is independent from sensor models.

The stochastic properties of the step input estimation method are unknown and are not straightforwardly evident. To validate the method for metrology applications, we studied the estimate uncertainty by doing a statistical analysis of the step input estimation. The estimate uncertainty can be defined in terms of the estimate bias and variance. The statistical analysis of the estimation method yields expressions that predict the estimate first and second moments.

We computed the Crámer-Rao bound of the structured EIV problem to determine the minimum theoretical variance of the estimate. This bound was compared to the estimate mean squared error (MSE) in simulations and in experiments with temperature and weighing sensors. It was found that the input estimation is biased but with small variance, and that the estimate MSE is less than one order of magnitude larger than the Crámer-Rao bound. In the practice, the step input estimation method was found to be robust when the Gaussian and white measurement noise assumption was not satisfied.

THE COMPOSITION OF PhD Juries ARE BEING APPROVED BY THE FACULTY BOARD. THE JURIES TO BE APPROVED BY THE FACULTY BOARD ALWAYS HAVE TO BE SENT TO THE PRESIDENT OR VICE PRESIDENT OF THE PHD COMMITTEE OF THE FACULTY FOR APPROVAL TWO WEEKS (14 days) BEFORE THE MEETING OF THE FACULTY BOARD.