nonlinear control problem to one that is easy to regulate in a desired manner. Thereby, our method combines the flexibility of non-parametric Bayesian learning with epistemological guarantees on the expected closed-loop trajectory. We illustrate our method in the context of a cart-pole example with an uncertain friction map.

11. **Title:** Correlation analysis for affine LPV system identification
**Authors: Pepijn B. Cox** (TU Eindhoven, The Netherlands), Mihály Petreczky (Ecole des Mines de Douai, France), Roland Tóth (TU Eindhoven, The Netherlands) and Paul M.J. Van den Hof (TU Eindhoven, The Netherlands)
**Abstract:** Estimation of linear parameter-varying state-space models with affine dependence on the scheduling parameter (LPV-SSA) is proposed by using correlation analysis (CRA) of the corresponding input-output (IO) map. The IO map is represented in the form of a parameter-varying impulse response function, which is composed from the so called sub-Markov parameters of the deterministic part of the data-gerneating system. These parameters are estimated via CRA and tested against a significance bound to accomplish model structure selection in terms of dependency structure on the scheduling, delays, sparsity, etc. Combining the CRA based estimation of the sub-Markov parameters and a Kalman-Ho-like realization algorithm allowes the construction of a minimal LPV-SSA model estimate. In addition, model order reduction can be applied during the LPV-SSA realization via a singular value decomposition method.

12. **Title:** Data-driven feedforward tuning based on closed-loop identification techniques
**Authors: Frank Boeren** and Tom Oomen (TU Eindhoven, The Netherlands)
**Abstract:** In this work, feedforward control is re-investigated from an system identification perspective. In recent years, the design of feedforward controllers has evolved from model-based designs into direct tuning approaches based on measured data. The aim of this poster is to improve existing data-based tuning procedures by exploiting closed-loop identification techniques. First, tuning of feedforward controllers is reformulated as the estimation of an inverse model of a dynamical system in a closed-loop configuration. Then, closed-loop identification techniques are used to obtain unbiased estimates with optimal accuracy. Furthermore, an analysis is provided of the value of iterations and stochastic approximation algorithms in inverse model identification. Experimental results on a motion system confirm that the presented approach outperforms pre-existing methods.

13. **Title:** Full nonparametric identification of the instantaneous dynamics of linear time-periodic systems
**Authors: Ebrahim Louarroudi**, Rik Pintelon and John Lataire (ELEC-VUB, Belgium)
**Abstract:** As (quasi) time-periodic (TP) systems are encountered in many engineering applications, ranging from reciprocating devices in the field of mechanics, through harmonic distortions in power distribution networks, to cardio-vascular monitoring in the bio-medical science, the extraction of experimental linear time-periodic (LTP) models meant for physical interpretation, analysis, prediction or control can be a useful step for the practicing engineer. Most of the identification methods available in the LTP literature are (non-)parametric-in-the-dynamics and parametric-in-the-time-variations. Because a full nonparametric model avoids a model order selection for the dynamics as well as for the time-variation part, it is more than welcome to have full nonparametric identification tools at hand. Estimation schemes, which are both nonparametric-in-the-dynamics as well as in-the-time-variations, for slowly varying dynamics are based on the short-time Fourier transform (STFT) principle. However, this can be a very restrictive assumption for applications with fast time-variations. To circumvent this problem, we show that when the excitation is a stationary random process the identification problem boils down to the estimation of the time-periodic cross-power spectral density (PSD) in the extended Wiener-Hopf relation:

time-periodic cross-PSD = instantaneous dynamics × input auto-PSD.

This input-output relationship is always fulfilled irrespective of the speed and strength of the cyclic variations. As there is quite a lot of research done on how to estimate cyclo-/non-stationary auto-PSDs from noisy data, ideas can be used to estimate the time-periodic cross-PSD. For instance, by measuring a sufficient amount of system cycles an unbiased nonparametric estimate can be constructed for the time-periodic cross-PSD through synchronous averaging.

14. **Title:** Identification of a flexible block-oriented model
**Authors: Anne Van Mulders** and Laurent Vanbeylen (ELEC-VUB, Belgium)
**Abstract:** Previous work on the identification of a class of structured nonlinear systems is extended. The considered system is block-oriented (consisting of linear dynamic and static nonlinear (SNL) blocks) and is called NL-LFR (nonlinear Linear Fractional Representation). It is very flexible and encompasses many other block-structures. The previous result was devoted to the case of an NL-LFR model with several Single-Input Single-Output (SISO) SNLs. This is here extended towards several Multiple-Input Single-Output (MISO) SNLs. After the identification of a partly structured polynomial state-space model, the dynamics and nonlinearities are split algebraically, decomposing the multivariate polynomial coefficients. This algebraic split of multivariate polynomials is obtained by means of a tensor decomposition.

15. **Title:** Benefits of the linear fractional representation in nonlinear block-oriented modelling
**Authors: Laurent Vanbeylen** and Anne Van Mulders (ELEC-VUB, Belgium)
**Abstract:** Nonlinear block-oriented models are quite popular due to their simplicity. However, appropriate structure detection tools to select the most appropriate type of nonlinear block-oriented model are lacking, which constitutes a vast open problem. By taking a step back, and viewing the nonlinear system as a linear fractional transformation of a static nonlinearity (NL-LFR), the structure detection issue can be circumvented. In an NL-LFR, the nonlinearity is placed in a quite general linear dynamic environment, which delivers a structure where the full power of the MIMO linear identification tools can be reused. Moreover, the model is adequate to naturally describe the behavior of systems where one nonlinearity is dominant. The discussion will cover the definition, general properties, generalizations of the NL-LFR model and a number of application examples.

16. **Title:** Nitrate and pesticide propagation modelling
**Authors: Vincent Laurain** (University of Lorraine, France), Marion Gilson (University of Lorraine, France) and Marc Benoit (INRA, France)
**Abstract:** A system identification application in an unusual context is presented in this poster: the modelling of nitrogen propagation in drinking water in agricultural regions. It presents rapidly the tradition of physics-based modeling widely used by agronomists and how they face a dead-end when it comes to the application of these models in practical realistic and actually