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Optimal excitation of dynamical systems for parameter identification

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Reliable simulation models are crucial in virtual engineering processes. Typically, the system of differential equations in these models is rather well known. However, the development of new product classes requires new parametrizations of the system. This often leads to vast experimental programs needed to acquire all necessary data to determine relevant parameters. The choice of experiments, i.e., how to excite the system best to obtain the relevant information, is non-trivial.
In this talk, we propose a method to optimize the system excitation w.r.t. the parameter sensitivity in a known differential equation system. We therefore model the parameters as probabilistic variables and make use of polynomial chaos expansion to augment the probabilistic equations into a deterministic surrogate model. The obtained surrogate model serves as a basis for optimization of the parameter sensitivities w.r.t. the input signal.
The proposed method allows for a systematic derivation of suitable excitation functions for the parameter identification of the system. We demonstrate the method in the context of vehicle models.

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