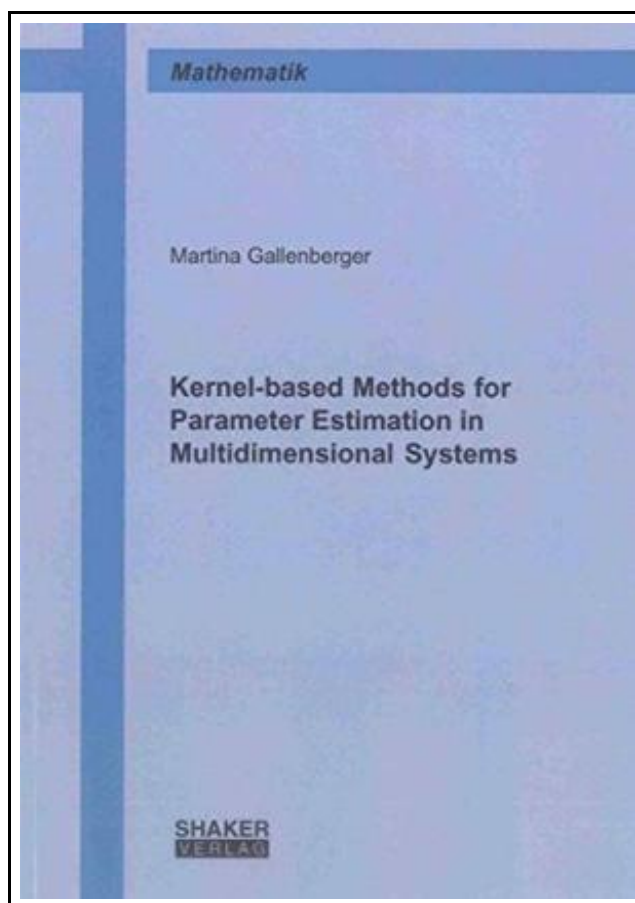# Kernel-based Methods for Parameter Estimation in Multidimensional Systems

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Reviews

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KERNEL-BASED METHODS FOR PARAMETER ESTIMATION IN MULTIDIMENSIONAL SYSTEMS

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Shaker Verlag Sep 2013, 2013. Buch. Book Condition: Neu. Neuware - In this thesis, we show how kernel regularization approaches can be used for parameter estimation in different multidimensional systems. We study this problem in the context of reproducing kernel Hilbert spaces of vector-valued functions. This also allows interpretation in terms of Gaussian processes and RBF approximation networks. The results of the thesis are the extension of estimation methods to the case of vector-valued data which includes the development of new approximation approaches or optimization criteria. Furthermore, we present a new model for the glucose-insulin regulatory system illustrating recent biological results. This model is used as a concrete example for the use of a RBF approximation network to estimate the solution of a system of differential equations. In the first chapter we summarize two basic concepts for estimating vector-valued functions based on a finite set of measurements. As this problem is ill-posed, we consider regularization approaches for function estimation. First, we present the main results of the theory of operator-valued reproducing kernels and corresponding reproducing kernel Hilbert spaces (RKHS) of vector-valued functions. We recall the one-to-one relationship of operator-valued kernels and RKHS, the concept of minimal norm interpolation in RKHS, and its extension to regularization approaches in a vector-valued setting. We then describe Gaussian process regression for learning vector-valued functions. We present the weight-space view using Bayesian inference and the corresponding function-space view based on the assumption that the predictive function is drawn from a vector-valued Gaussian process. Furthermore, we show that both perspectives lead to the same regularized risk functional, which is a consequence of the correspondence of RKHS and Gaussian processes. Using the theory of RKHS discussed in the first chapter, we extend different methods for scalar measurements to the case of vector-valued data. The advantage of our...

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