Optimal Recovery of Multivariate Functions: From Theory to Applications

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In practice, one often faces the problem of reconstructing a multivariate function from a given, finite data set. In the simplest case, such a data set consists of *data values* $f_j = f(x_j) \in \mathbb{R}$, $1 \leq j \leq N$, coming from an unknown function f at certain *data sites* $X = \{x_1, \ldots, x_N\} \subseteq \Omega \subseteq \mathbb{R}^d$. A genuine reconstruction is difficult since the data sites are, in general, scattered over the region Ω, bearing no structure at all. Moreover, the data values might contain measurement errors or noise.

The process of approximatively reconstructing the function f from such discrete information by optimal recovery will be the subject of my talk. To be more precise, I will address the following topics:

(1) Optimal recovery in reproducing kernel Hilbert spaces

(2) Error estimates for interpolation/approximation

(3) Numerical aspects of the reconstruction process

(4) Examples from computer graphics and fluid-structure interaction