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RICAM JOHANN-RADON-INSTITUTE FOR COMPUTATIONAL AND APPLIED MATHEMATICS

Group Seminar

Multivariate Algorithms and Quasi-Monte Carlo Methods

Algorithms and Complexity for Functions on General Domains

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Abstract

Error bounds and complexity bounds in numerical analysis and information-based complexity are often proved for functions that are defined on very simple domains, such as a cube, a torus, or a sphere. We study optimal error bounds for the approximation or integration of functions defined on $D_d \subset \mathbb{R}^d$ and only assume that D_d is a bounded Lipschitz domain. Some results are even more general. We study three different concepts to measure the complexity: order of convergence, asymptotic constant, and explicit uniform bounds, i.e., bounds that hold for all n (number of pieces of information) and all (normalized) domains.

It is known for many problems that the order of convergence of optimal algorithms does not depend on the domain $D_d \subset \mathbb{R}^d$. We present examples for which the following statements are true:

1. Also the asymptotic constant does not depend on the shape of D_d or the imposed boundary values, it only depends on the volume of the domain.
2. There are explicit and uniform lower (or upper, respectively) bounds for the error that are only slightly smaller (or larger, respectively) than the asymptotic error bound.