obtained by interpolation. Full grid interpolation methods suffer from the so-called curse of dimensionality, rendering them infeasi-In simulation technology, computationally expensive objective functions are often replaced by cheap surrogates, which can be (continuously differentiable). Hence, these basis functions are unsuitable for applications in which gradients are required. One example for such an application is gradient-based optimization, ble if the parameter domain of the function is higher-dimensional four or more parameters). Sparse grids constitute a discretization method that drastically eases the curse, while the approximation in which the availability of gradients greatly improves the speed quality deteriorates only insignificantly. However, conventional basis functions such as piecewise linear functions are not smooth of convergence and the accuracy of the results.

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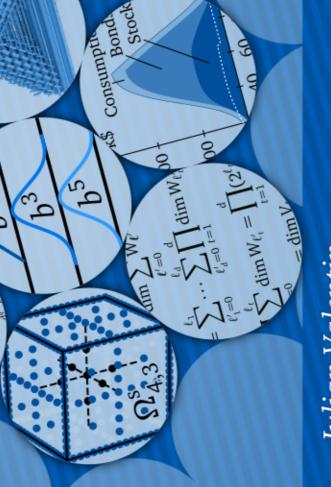
Valentin

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In the first part, we derive new B-spline bases on sparse grids and study their implications on theory and algorithms. In the second part, we consider three real-world applications in optimization: topology optimization, biomechanical continuummechanics, and dynamic portfolio choice models in finance. The dimensionalities. The thesis is organized in two main parts: results reveal that the optimization problems of these applica-This thesis demonstrates that hierarchical B-splines on sparse grids are well-suited for obtaining smooth interpolants for higher tions can be solved accurately and efficiently with hierarchical B-splines on sparse grids.







Julian Valentin

B-SPLINES FOR SPARSE GRIDS

Higher-Dimensional Optimization Algorithms and Application to