

Hierarchical Tensor Representation

Wolfgang Hackbusch

Max-Planck-Institute, Germany

We are not only interested in the efficient storage of high-dimensional tensors, but also in the efficient evaluation and possibly approximation of the tensor operations. Since all types of representation tend to increase a certain rank under the operations, an efficient tensor calculus must contain an efficient method for the rank truncation of the intermediate results. Here, the traditional representations are less attractive, since rank truncation leads to nonlinear optimisation problems.

In the lecture we describe a new representation scheme with the following properties: 1) tensors represented in the n -term representation, in the Tucker format, or in the sparse-grid form are exactly representable in the new scheme with similar storage cost as in the original form. 2) The truncation can be performed (non-iteratively) only on the basis of singular value decompositions.

The operations count for the basic tensor operations can be described. In particular, they are linear in the order (dimension) of the tensor.