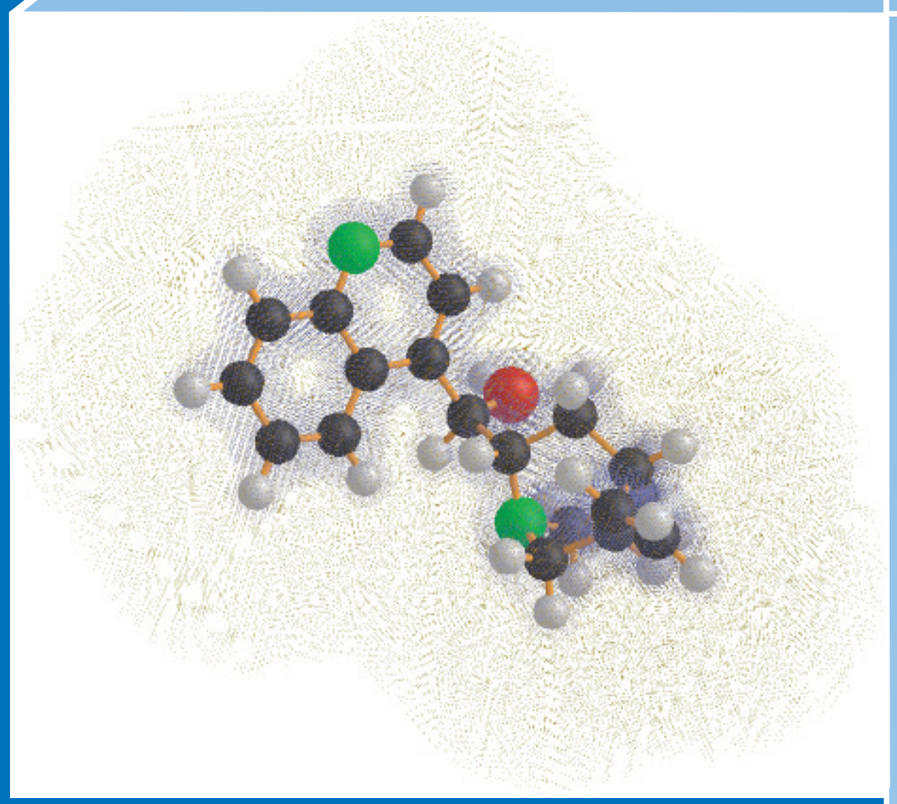
Berlin Mathematical School

BMS Friday Colloquium

Friday 19 April 2013 at 14:15

Tea & Cookies starting at 13:00

BMS Loft, Urania, An der Urania 17, 10787 Berlin



Reinhold Schneider

(TU Berlin)

Hierarchical Tensor Product Representations

The numerical solution of differential equations or other problems in high dimensions is very challenging, due to the *curse of dimensionality*. Typical high-dimensional problems include the Fokker–Planck equation and the many-particle Schrödinger equation. Low-rank tensor-product approximation – in analogy to low-rank matrix approximation – gives a way to circumvent the curse of dimensionality, but beyond the matrix case, fundamental mathematical problems appear. Hierarchical Tucker represenations (recently introduced by Hackbusch, among others) offers new possibilities. We will compare these techniques with traditional tensor-product approximations. As a new improvement, we will show that the hierarchical tensors of given rank form a differentiable manifold.

For solving optimation problems of given type (like L_2 approximation, linear equations or eigenvalue problems), we formulate gradient flows and projected gradient methods. Recent research tries to incorporate expertise from quantum physics. For instance, we demonstrate an effective numerical tool for optimization – the alternating linear scheme – based on alternating directions. This scheme resembles the density matrix renormalization group algorithm from quantum physics.

Reinhold Schneider gained his doctorate and habilitation in Darmstadt. After professorships in Chemnitz and Kiel, he came to Berlin in 2007 as MATHEON-Professor at TU Berlin.

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