

Sparsified Randomization Algorithms for the Low Rank Approximations of Very Large Matrices, and Applications for Solving Inverse Problems in X-Ray Diffraction

Karl Sabelfeld

Institute of Mathematical Modelling and Geophysics, Russia

Sparsified Randomization Monte Carlo (SRMC) algorithms introduced in my recent paper of 2009 for solving large systems of linear algebraic equations are extended to construct the SVD based randomized low rank approximations for large matrices. I suggest some efficient implementations of SRMC based low rank approximations, and give different applications. In particular, I combine this method with an algorithm for solving boundary integral equations based on a separation representation of the kernel. Another important application I present in this talk is a fast simulation algorithm for a randomized approximation of non-homogeneous random fields based on a discrete version of the Karhunen-Loève expansion. I present two examples of non-homogeneous random fields simulation which include a long-correlated Lorenzian processes, and the fractal Wiener process. An application of the method for solving an inverse problem in x-ray diffraction analysis of dislocations in crystals is presented.