Bloch decomposition-based stochastic Galerkin/Collocation method for Schrödinger equation with random inputs

Zhongyi Huang

Department of Mathematical Sciences, Tsinghua University, China

Email: zhongyih@mail.tsinghua.edu.cn

In this talk, we focus on the analysis and numerical methods for the Schrödinger equation with lattice potential and random inputs. Here we recall the well-known Bloch decomposition-based split-step pseudo-spectral method where we diagonalize the periodic part of the Hamilton operator so that the effects from dispersion and periodic lattice potential are computed together. Meanwhile, for the random non-periodic external potential, we utilize the generalized polynomial chaos with Galerkin procedure to form an ode system which can be solved analytically. Furthermore, we analyze the convergence theory of the stochastic collocation method for the linear Schrödinger equation with random inputs. We provide sufficient conditions on the random potential and initial data to ensure the spectral convergence.

References:

[1] Zhizhang Wu, Zhongyi Huang, *A Bloch decomposition-based stochastic Galerkin method for quantum dynamics with a random external potential,* J. Comput. Phys. 317 (2016): 257–275.

[2] Zhizhang Wu, Zhongyi Huang, *Convergence Analysis on Stochastic Collocation Methods for Schrödinger Equation with Random Perturbations,* preprint.