Spectral methods have been used extensively in numerical approximation of partial differential equations due to their bigger accuracy when compared to Finite Differences (FD) and Finite Elements (FE) methods. However, FD and FE usually lead to a sparse linear system while spectral methods often suffer from the huge computational complexity caused by dense matrices. Fortunately, although the matrices arising from spectral methods are dense, they enjoy a hidden nice property, named low-rank structure, which means their off-diagonal blocks have small (and even bounded) numerical ranks for a given tolerance. This property could be exploited to dramatically reduce the computational cost and give birth to fast solvers with nearly optimal complexity and memory, thanks to the hierarchically semiseparable (HSS) representation for structured matrices. The Fast Structured Spectral Methods presented here include fast structured Jacobi transforms, fast structured spectral Gelerkin methods for differential equations with variable coefficients and fast structured spectral collocation methods.

BIOGRAPHICAL

Yingwei Wang graduated with the Bachelor and Master degree in Applied Mathematics from Tongji University, Shanghai, China in 2010. He is now a PhD candidate in Department of Mathematics at Purdue University, working with Professor Jie Shen. His research goal is to develop efficient spectral and high-order numerical methods for partial differential equations. Currently, his is working on the fast structured spectral methods.

wang838@purdue.edu