



復旦大學
FUDAN UNIVERSITY

Applied Math
Ph.D. Seminar

On Two-Stage Householder Orthogonalization

Speaker: Zhuang-Ao He (Fudan University)

Time: 2026-04-30, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Advisor: Meiyue Shao (Fudan University)

Abstract: Two-stage orthogonalization is essential in numerical algorithms such as Krylov subspace methods. For this task we need to orthogonalize a matrix A against another matrix V with orthonormal columns. A common approach is to employ the block Gram–Schmidt algorithm. However, its stability largely depends on the condition number of $[V, A]$. While performing a Householder orthogonalization on $[V, A]$ is unconditionally stable, it does not utilize the knowledge that V has orthonormal columns. To address these issues, we propose a two-stage Householder orthogonalization algorithm based on the generalized Householder transformation. Instead of explicitly orthogonalizing the entire V , our algorithm only needs to orthogonalizes a square submatrix of V . Theoretical analysis and numerical experiments demonstrate that our method is also unconditionally stable.