



復旦大學
FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

Backward Error Analysis and Randomized Algorithms for Total Least Squares

Speaker: Jiali Shan (Fudan University)

Time: 2026-10-22, 16:10 to 17:00

Location: Rm 1801, Guanghai East Tower

Advisor: Yimin Wei (Fudan University)

Abstract: Total least squares (TLS) extends least squares (LS) by accounting for errors in all variables, making it a natural framework for data fitting under measurement uncertainty. A better understanding of TLS can also inform the development of null-space estimation algorithms. Compared with LS, however, the theoretical foundations of TLS remain less fully developed.

In this talk, we study TLS through the lens of backward error analysis. We derive an explicit expression for the optimal backward error of the general multidimensional TLS (mTLS) problem. To facilitate practical computation, we propose an efficiently computable estimate with a tight bound for the single right-hand-side case, together with a randomized approach for computing the backward error in the multidimensional setting. These results reveal close connections between LS and TLS. Finally, we present an algorithmic improvement to RQI-SPCGTLS, whose design also brings into focus the fundamental difficulties in extending LS theory to TLS.