FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

High Precision Computation of Floquet Multipliers and Subspaces using Periodic Polynomial Eigenvalue Problem

Speaker: Yehao Zhang (Fudan University)

Time: 2025-12-04, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Advisor: Yangfeng Su (Fudan University)

Abstract: Accurate and efficient computation of Floquet multipliers and subspaces is essential for analyzing limit cycle in dynamical systems and periodic steady state in Radio Frequency (RF) simulation. This problem is typically addressed by solving a periodic linear eigenvalue problem, which is discretized from the linear periodic time-varying system using one-step methods. The backward Euler method offers a computationally inexpensive overall workflow but has limited accuracy. In contrast, one-step collocation methods achieve higher accuracy through over-sampling, explicit matrix construction, and condensation, but become costly for large-scale sparse cases. We apply multistep methods to derive a periodic polynomial eigenvalue problem, which introduces additional spurious eigenvalues. Under mild smoothness assumptions, we prove that as the stepsize decreases, the computed Floquet multipliers and their associated invariant subspace converge with higher order, while the spurious eigenvalues converge to zero. To efficiently solve large-scale problem, we propose pTOAR, a memory-efficient iterative algorithm for computing the dominant Floquet eigenpairs. Numerical experiments demonstrate that our method achieves high order accuracy, while its computational and memory costs are only marginally higher than those of the backward Euler method.