

ADVANCES IN NUMERICAL METHODS AND THEORIES FOR HIGH DIMENSIONAL PROBLEMS

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ABSTRACT

High-dimensional problems are ubiquitous in scientific computing, arising in kinetic theory, quantum physics, multiscale flow and transport, and inverse problems, among others. Theories and numerical algorithms faces fundamental challenges due to the curse of dimensionality, demanding novel algorithmic frameworks and rigorous mathematical foundations. This minisymposium brings together researchers to present recent advances in structure-exploiting numerical methods for high-dimensional problems, spanning low-rank tensor approximations, model order reduction, multiscale techniques, AI-based surrogate modeling and PDE theories. These contributions highlight emerging algorithmic frameworks and mathematical theories that overcome the computational barriers of the curse of dimensionality across diverse scientific applications.

SPEAKERS

1. Jingwei Hu (University of Washington): Dynamical tensor train approximation for kinetic equations
2. Wei Guo (Texas Tech University): Incremental Tensor-Train Compression from Streaming TT-Formatted Data
3. Pia Stammer (Affiliation): Dynamically adaptive low-rank and mesh refinement for high-dimensional transport problems in radiation therapy
4. Jiahua Jiang (Shanghai Tech University): Deep Unrolled Nonlocal Gaussian Prior: An Zero-shot Learning Method for Fluorescence Molecular Tomography

5. Zhichao Peng (The Hong Kong University of Science and Technology): Sweeping-based Relaxed Low-rank Source Iteration and GMRES for Radiative Transfer Equation
6. Daniele Venturi (University of California, Santa Cruz): Computing with traceable tensor network
7. Jonas Kusch (Norwegian University of Life Sciences): TBD
8. Xun Tang (The Hong Kong University of Science and Technology): TBD
9. Siu Wun "Tony" Cheung (Lawrence Livermore National Laboratory): Reduced order modeling for accelerating physics simulations: theory, open-source implementation, reproducible benchmarks, and applications
10. Juntao Huang (University of Delaware): TBD
11. Wing Tat Leung (City University of Hong Kong): Multiscale Multicontinuum Homogenization for Coupled Flow and Transport in Heterogeneous Media
12. Haitian Yue (Shanghai Tech University): TBD