

个人简历

自我介绍：

张晨松，男，1977年1月生。中国科学院数学与系统科学研究院，研究员。1995年和1999年分别获南京大学数学系学士和硕士，2007年获美国马里兰大学应用数学博士学位。2007年—2010年、2010年—2011年在美国宾州州立大学数学系和北京大学数学科学学院从事博士后研究。2011年加入中国科学院数学与系统科学研究院。主要研究方向：自适应方法、多重网格法、非线性耦合方程的预条件方法。构造了全隐式油藏数值模拟的代数解耦方法、多阶段预条件方法、组合型预条件方法等方法，并开发了油藏模拟分布式并行求解器，成果获得CSIAM首届应用数学落地成果认证（2021年）。

在Handbook of Numerical Analysis、M3AS、SINUM、Numer Math、MMS、JCP等计算数学国际一流期刊发表了多篇学术论文。先后主持教育部留学归国基金、国家自然科学基金、中国科学院前沿重点研究项目、国防科工局科学挑战专题项目、华为解法器技术合作项目等科研项目。现任中国工业与应用数学会油水资源数值模拟方法专委会副主任和数学与产业专委会委员，中国运筹学会算法软件与应用分会（筹）副理事长，中国流变学专委会委员，《数值计算与计算机应用》编委。2023年，兼任中国科学院大学岗位教师、深圳市大数据研究院研究科学家。

教育经历：

- 2002.9—2007.6：美国马里兰大学 博士学位（导师：Ricardo Nochetto）
- 1999.9—2002.7：南京大学数学系 硕士学位（导师：何炳生）
- 1995.9—1999.7：南京大学数学系 学士学位

科研项目：

1、基金项目：

- 2009.9-2012.8：美国自然科学基金NSF-DMS-0915153 《User-friendly Solvers and Solver-friendly Discretizations》，联合主持

- 2011.1-2014.12: 中国科学院海外优秀人才引进计划, 主持
- 2012.1-2014.12: 国家自然科学基金重大研究计划培育项目NSFC-91130011《大规模离散系统并行多层迭代法及其软件研制》, 参与
- 2012.1-2015.12: 863计划《高效能计算机及应用服务环境》子课题, 参与
- 2014.1-2014.12: 教育部留学归国科研基金Y390041G26,《欧拉-拉格朗日离散方法的自适应与多层迭代法研究》, 主持
- 2016.1-2020.12: 中国科学院前沿科学重点研究项目QYZDB-SSW-SYS018,《组分模型的并行求解算法研究》, 主持
- 2015.1-2018.12: 国家自然科学基金重大研究计划重点项目NSFC-91430215,《人工心脏流固耦合问题的并行数值模拟算法与应用》, 参与
- 2016.1-2018.12: 国家自然科学基金重大研究计划集成项目,《基于国产神威100PF系统的高性能算法库研究》, 参与
- 2019.1-2020.12: 国防科工局科学挑战专题资助子课题TZZT2019-B1.1,《赋能型解法器算法框架和智能平台设计》, 主持
- 2020.1-2023.12: 国家自然科学基金面上项目NSFC-11971472,《微分方程组的代数多层迭代法》, 主持
- 2021.1-2025.12: 科技部国家重点研发计划《集成电路设计自动化(EDA)中的创新数学理论和方法》, 参与
- 2024.1-2028.12: 中国科学院战略性先导科技专项《工业软件CAX一体化的计算内核》, 参与
- 2024.7-2027.6: 中国科学院战略性先导科技专项《极端宽域高效气动热力机理与调控》, 参与

2、企业合作:

- 2009.12-2011.6: 中海油国家科技重大专项《海上稠油化学驱油技术》子课题, 主要成员
- 2011.1-2013.12: 中石油国际科技合作项目《油藏模拟线性方程组求解技术》, 主要成员

- 2015.1-2015.12: 北京应用物理与计算数学研究所开放课题《面向工程力学中流固耦合计算的线性代数求解算法研究》，主持
- 2020.1-2022.9: 中石油国际科技合作项目《多组分大规模精细数值求解模块研发》，主要成员
- 2020.1-2020.12: 中国石油勘探开发研究院《个性化井网设计软件功能和性能测试》，主持
- 2020.1-2020.12: 中国石油勘探开发研究院《非等温模型线性系统解法库》，主持
- 2020.1-2023.12: 中国石油重大科技项目《深层碳酸盐岩油气藏开采机理及油藏数值模拟技术研究》，参与
- 2022.8-2023.8: 华为技术有限公司《面向力学仿真的高性能求解算法研究》，主持
- 2023.1-2023.12: 中国石油勘探开发研究院《页岩气数值模拟技术调研》，主持
- 2023.4-2024.4: 中科可控信息产业有限公司《基于国产加速器的高效代数多层网格法预条件迭代求解器研发》，参与

荣誉与大会报告:

- 2024年, 中国运筹学会算法软件与应用分会第2届年会邀请报告
- 2022年, 第15届国际多重网格法会议大会(瑞士)特邀报告
- 2021年, 首届CSIAM应用数学落地成果认证
- 2020年, Best Thematic Track Paper Award, ICCS2020国际计算科学大会(荷兰)
- 2013年, 第16届全国流体力学数值方法会议大会特邀报告
- 2012年, 第二十一届国际区域分解法会议(法国)大会特邀报告
- 2011年, 国际计算科学、工程与金融会议大会邀请报告
- 2007年, 马里兰大学院长优秀博士论文奖
- 2006年, 马里兰大学Seymour Goldberg研究生论文奖

部分发表论文：

1. MGCFNN: A neural multigrid solver with novel Fourier neural network for high wave number Helmholtz equations, Y. Xie, M. Lv, and C.-S. Zhang, The 13th International Conference on Learning Representations (ICLR'25). CORE2023 Rank A*.
2. A MgNO method for multiphase flow in porous media, X. Liu, X. Yang, C.-S. Zhang, L. Zhang, and L. Zhao, Proceedings of the 16th Annual Meeting Conference on Porous Media. InterPore 2024, 953–969 (04/2025). Springer, Singapore.
3. A super-localized finite element method for inhomogeneous fourth-order singular perturbation problem, B. Dai and C.-S. Zhang, Applied Mathematics Letters, 166, 109534 (03/2025). IF2024:2.9.
4. Semi-StructMG: A fast and scalable semi-structured algebraic multigrid, Y. Zong, C.-S. Zhang, L. Mu et al. The 30th ACM SIGPLAN Annual Symposium on Principles and Practice of Parallel Programming (PPoPP'25), 496–511 (02/2025). CCF2022 Rank A.
5. A Stokes-dual-porosity-poroelasticity model and discontinuous Galerkin method for the coupled free flow and dual porosity poroelastic medium problem, R. Li, C.-S. Zhang, Z. Chen, Journal of Scientific Computing, online first, 102:41 (01/2025).
6. Lowest-degree robust finite element schemes for inhomogeneous bi-Laplace problems, B. Dai, H. Zeng, C.-S. Zhang, and S. Zhang, Applied Numerical Mathematics, 203, 235--254 (09/2024). IF2022:2.994.
7. AutoAMG(θ): An auto-tuned AMG method based on deep learning for strong threshold, H. Zou, X. Xu, C.-S. Zhang, and Z. Mo, Communications in Computational Physics, 36, 200--220 (07/2024). IF2022:3.791.
8. StructMG: A fast and scalable structured multigrid, Y. Zong, X. Wang, H. Huang, C.-S. Zhang et al., Poster at PPoPP'24: Proceedings of the 29th ACM SIGPLAN Annual Symposium on Principles and Practice of Parallel Programming, 478--480 (08/2024).
9. Application-oriented preconditioning of seepage mechanics, C. Feng, S. Li, S. Liu, C.-S. Zhang, L. Zhao, Chinese Journal of Computational Physics, 41, 98--109 (01/2024).
10. A Stokes–Darcy–Darcy model and its discontinuous Galerkin method on polytopic grids, R. Li, Y. Gao, C.-S. Zhang, Z. Chen, Journal of Computational Physics, 112780 (01/2024). IF2022:4.645.
11. On the existence of locally-defined projective interpolations, H. Zeng, C.-S. Zhang, and S. Zhang, Applied Mathematics Letters, 146, 108789 (12/2023). IF2022:4.294.

12. An improved multistage preconditioner on GPUs for compositional reservoir simulation
L. Zhao, S. Li, C.-S. Zhang et al., CCF Transactions on High Performance Computing (02/2023).
13. Parallel multi-stage preconditioners with adaptive setup for the black oil model, L. Zhao, C. Feng, C.-S. Zhang, and S. Shu, Computers & Geosciences, 168, 105230 (10/2022). IF2022: 5.168.
14. A low-degree strictly conservative finite element method for incompressible flows, H. Zeng, C.-S. Zhang, and S. Zhang, SMAI Journal of Computational Mathematics, 8, 225–248 (09/2022).
15. A new analytical framework for the convergence of inexact two-grid methods, X. Xu and C.-S. Zhang, SIAM Journal on Matrix Analysis and Applications, 43, 512–533 (03/2022). IF2020:1.944.
16. Linear solvers for petroleum reservoir simulation, C.-S. Zhang, Journal on Numerical Methods and Computer Applications, 43, 1–26 (03/2022), in Chinese.
17. Convergence analysis of inexact two-grid methods: A theoretical framework, X. Xu and C.-S. Zhang, SIAM Journal on Numerical Analysis, 60, 133–156 (01/2022). IF2020:3.212.
18. An advanced ALE-mixed finite element method for a cardiovascular fluid–structure interaction problem with multiple moving interfaces, P. Sun, C.-S. Zhang, R. Lan, L. Li, Journal of Computational Science, 50, 101300 (01/2021). IF2020:3.976.
19. Optimal quadratic element on rectangular grids for H1-problems, H. Zeng, C.-S. Zhang, and S. Zhang, BIT Numerical Mathematics, 665–689 (08/2020). IF2020:1.663.
20. Monolithic arbitrary Lagrangian–Eulerian finite element method for a multi-domain blood flow–aortic wall interaction problem, P. Sun, C.-S. Zhang, R. Lan, and L. Li, In: Krzhizhanovskaya V. et al. (eds), Proceeding of International Conference on Comp. Sci. 2020 (CORE Rank A). Lecture Notes in Computer Science, vol 12143, 60–74 (06/2020). Springer, Cham. Best Thematic Track Paper of ICCS2020.
21. A numerical simulator for modeling the coupling processes of subsurface fluid flow and reactive transport processes in fractured carbonate rocks, T. Yuan, C. Wei, C.-S. Zhang, and G. Qin, Water, 11, 1957, 1–18 (10/2019). IF2020:3.103.
22. Distributed Lagrange multiplier/fictitious domain finite element method for a transient Stokes interface problem with jump coefficients, A. Lundberg, P. Sun, C. Wang, and C.-S. Zhang, Computer Modeling in Engineering and Sciences, 119, 35–62 (04/2019). IF2020:1.593.

23. Multiscale hybrid-mixed finite element method for flow simulation in fractured porous media, P. Devloo, W. Teng, and C.-S. Zhang, *Computer Modeling in Engineering and Sciences*, 119, 145–163 (04/2019). IF2020:1.593.
24. A new estimate for a quantity involving the Chebyshev polynomials of the first kind, X. Xu and C.-S. Zhang, *Journal of Mathematical Analysis and Applications*, 476, 302–308 (03/2019). IF2020:1.583.
25. Numerical simulation of an immersed rotating structure in fluid for hemodynamic applications, W. Leng, C.-S. Zhang, P. Sun, et al., *Journal of Computational Science*, 30, 79–89 (01/2019). IF2020:3.976.
26. On the ideal interpolation operator in algebraic multigrid methods, X. Xu and C.-S. Zhang, *SIAM Journal on Numerical Analysis*, 56, 1693–1710 (06/2018). IF2018:2.322.
27. ALE method for a rotating structure immersed in fluid and its application to artificial heart pump in hemodynamics, P. Sun, W. Leng, C.-S. Zhang, et al., In Y. Shi, et al. (eds), *Proceeding of International Conference on Computational Science 2018 (CORE Rank A)*. *Lecture Notes in Computer Science*, 10862, 9–23 (06/2018), Springer.
28. Analytical decoupling techniques for fully implicit reservoir simulation, C. Qiao, S. Wu, J. Xu, and C.-S. Zhang, *Journal of Computational Physics*, 336, 664–681 (05/2017). IF2018:2.845.
29. An error-resilient redundant subspace correction method, T. Cui, J. Xu, and C.-S. Zhang, *Journal of Computing and Visualization in Science*, 18, 65–77 (01/2017).
30. Toward cost-effective reservoir simulation solvers on GPUs, Z. Li, S. Wu, J. Xu, and C.-S. Zhang, *Advances in Applied Mathematics and Mechanics*, 8, 971–991 (12/2016). IF2018:0.844.
31. Cost-effective parallel reservoir simulation on shared memory, S. Wu, B. Wang, Q. Li, J. Xu, C.-S. Zhang, and C. Feng, *SPE Asia Pacific Oil & Gas Conference and Exhibition*, Perth, Australia (10/2016).
32. A stable and scalable hybrid solver for rate-type non-Newtonian fluid models, Y.-J. Lee, W. Leng, and C.-S. Zhang, *Journal of Computational and Applied Mathematics*, 300, 103–118 (07/2016). IF2018:1.883.
33. An adaptive hybrid stress transition quadrilateral finite element method for linear elasticity, F.-T. Huang, X.-P. Xie, and C.-S. Zhang, *Journal of Computational Mathematics*, 34, 339–364 (07/2016). IF2018:1.238.

34. A multilevel preconditioner and its shared memory implementation for a new generation reservoir simulator, S. Wu, J. Xu, C. Feng, C.-S. Zhang, et al., *Petroleum Science*, 11, 540–549 (10/2014). IF2018:1.846.
35. A multi-stage preconditioner for the black oil model and its OpenMP implementation, C. Feng, S. Shu, J. Xu, and C.-S. Zhang, *Domain Decomposition Methods in Science and Engineering XXI*, LNCSE Series, Springer-Verlag Berlin Heidelberg, 129–140 (05/2014).
36. On adaptive Eulerian–Lagrangian method for linear convection-diffusion problems, X. Hu, Y.-J. Lee, J. Xu, and C.-S. Zhang, *Journal of Scientific Computing*, 58, 90–114 (01/2014). IF2018:2.370.
37. Numerical study of geometric multigrid on CPU–GPU heterogeneous computers, C. Feng, S. Shu, J. Xu, and C.-S. Zhang, *Advances in Applied Mathematics and Mechanics*, 6, 1–23 (01/2014). IF2018:0.844.
38. Application of auxiliary space preconditioning in field-scale reservoir simulations, X. Hu, J. Xu, and C.-S. Zhang, *Science China Mathematics*, 56, 2737–2751 (12/2013). IF2018:1.031.
39. Combined preconditioning with applications in reservoir simulation, X. Hu, S. Wu, X.-H. Wu, J. Xu, C.-S. Zhang, S. Zhang, and L. Zikatanov, *Multiscale Modeling and Simulation*, 11, 507–521 (08/2013). IF2017:2.277.
40. Application of an energy-minimizing algebraic multigrid method for subsurface water simulation, R. Cheng, X. Huang, S. Shu, J. Xu, C.-S. Zhang, S. Zhang, and Z. Zhou, *International Journal of Numerical Analysis and Modeling*, 10, 374–388 (02/2013). IF2016:0.850.
41. Global existence and uniqueness of solutions to discretized viscoelastic flow models, Y.-J. Lee, J. Xu, and C.-S. Zhang, *Mathematical Models and Methods in Applied Sciences*, 21, 1713–1732 (08/2011). IF2015:3.084.
42. Effects of integrations and adaptivity for the Eulerian–Lagrangian method, J. Jia, X. Hu, J. Xu, and C.-S. Zhang, *Journal of Computational Mathematics*, 29, 367–395 (06/2011). IF2015:0.731.
43. Stable finite element discretizations for viscoelastic flow models, Y.-J. Lee, J. Xu, and C.-S. Zhang, *Handbook of Numerical Analysis (HNA) Vol. 16, Numerical Methods for Non-Newtonian Fluids*, 371–432 (02/2011).
44. Multigrid methods for elliptic obstacle problems on 2D bisection grids, L. Chen, R. H. Nochetto, and C.-S. Zhang, *Domain Decomposition Methods in Science and Engineering*

- XIX, LNCSE Series, Springer-Verlag Berlin Heidelberg, 229–236 (01/2011). ISBN 978-3-642-11303-1.
45. A posteriori error analysis for a class of integral equations and variational inequalities, R. H. Nochetto, T. von Petersdorff, and C.-S. Zhang, *Numerische Mathematik*, 116, 519–552 (10/2010). IF2015:1.813.
 46. A coarsening algorithm on adaptive grids by newest vertex bisection and its applications, L. Chen and C.-S. Zhang, *Journal of Computational Mathematics*, 28, 767–789 (08/2010). IF2015:0.731.
 47. A posteriori error analysis for parabolic variational inequalities, K.-S. Moon, R. H. Nochetto, T. von Petersdorff, and C.-S. Zhang, *ESAIM: Mathematical Modelling and Numerical Analysis* 41, 485–511 (05/2007). IF2009:1.483.
 48. AFEM@matlab: A MATLAB package of adaptive finite element methods, L. Chen and C.-S. Zhang, Tech Report, University of Maryland at College Park (03/2007).
 49. A modified augmented Lagrangian method for a class of monotone variational inequalities, B.- S. He, H. Yang, and C.-S. Zhang, *European Journal of Operations Research* 159, 35–51 (11/2004). IF2009:2.158.

会议组织：

- July 22–25, 2024: Solver2024, Chengdu
- July 08–19, 2024: CUHK and CUHK–Shenzhen joint summer school on scientific computing and machine learning, Shenzhen
- May 18–20, 2024: Numerical algorithms for microfluidic chip simulation, Shenzhen
- May 13–16, 2024: Machine learning and big data in porous media, Interpore24, Qingdao
- Aug 7–11, 2023: Solver2023, Qinghai
- July 20–24, 2022: Solver2022, Chongqing
- Nov 12–14, 2021: Solver2021, Shaoshan
- Aug 6–8, 2020: Solver2020, Suzhou
- Sep 6–7, 2019: 5th Workshop on Numerical Methods for PDEs, Beijing
- Aug 11–16, 2019: International Multigrid Conference 2019, Kunming
- Jan 14, 2019: Workshop on High-Performance Numerical Algorithms and Software for Large-Scale Scientific and Engineering Applications, HPC Asia 2019, Guangzhou
- June 1–8, 2018: 5th Workshop on Inter-Facial Dynamics and FSI Problems, Beijing/Sanya
- Dec 5–6, 2015: International Forum on Petroleum Reservoir Simulation, Guangzhou

- Aug 5–7, 2015: Short course on multigrid methods and applications, Beijing
- July 15–25, 2013: Workshop on Scientific Computing with Application, Kunming
- Dec 6–7, 2012: International Forum on Petroleum Reservoir Simulation, Beijing
- Oct 28, 2011: Workshop on Math Methods in Petroleum Reservoir Simulation, Beijing
- Aug 01–10, 2011: Workshop on Algebraic Multigrid Methods, Kunming

邀请报告：

- 2022: Plenary Speaker, International Multigrid Conference, Lugano, Switzerland
- 2021: Invited Speaker, Summer School for Excellent Math Students, Nanjing University
- 2019: Invited Speaker, International Workshop on Multiphysics Problems, China
- 2019: Invited Speaker, Modeling & Simulation in Science, Saudi Arabia
- 2018: Invited Speaker, Lenovo HPC Summit, China
- 2016: Invited Speaker, International Conference on HPC Middleware, China
- 2015: Invited Speaker, 4th Brazil-China Conference on Scientific Computing, China
- 2015: Invited Speaker, 3rd International Conference on HPC and Applications, China
- 2013: Plenary Speaker, 16th National Symposium on Numerical Methods in Fluids, China
- 2013: Plenary Speaker, 4th Elsevier National Library Connect, China
- 2012: Plenary Speaker, 21st Intl. Conference on Domain Decomposition Methods, France
- 2011: Plenary Speaker, Symposium on Computational Science, Engineering and Finance, China

研究生与博士后：

- 赵梨，博士后，2023–至今
- 谢炎，硕士研究生，2021–至今
- 戴斌，硕士研究生，2020–至今
- 李仕哲，博士研究生，2019–至今
- 张凯雷，硕士研究生，2018–2021
- 曾慧兰，博士研究生，2016–2021
- 范荣红，博士研究生，2015–2020
- 徐雪枫，博士研究生，2014–2019

访问研究生：

- 张林杰，湘潭大学，03/2023-06/2023
- 赖婷，湘潭大学，07/2021-08/2021
- 古惠鹏，南方科技大学，07/2021-08/2021
- 齐浩然，宾州州立大学，09/2020-12/2020
- 腾文超，中国石油大学（华东），07/2017-12/2017
- 邹海峰，北京工业大学，09/2016-06/2018
- 李政，湘潭大学，09/2014-12/2016

教学经验：

- 2023年：中国科学院大学研究生课程《多层迭代法》
- 2022年：中国科学院大学研究生课程《大规模方程组求解器前沿选讲》
- 2021年：南京大学本科生暑期学校《面向超级计算的并行算法及应用》
- 2020年：中国科学院大学研究生课程《多层迭代法》
- 2018年：中国科学院大学研究生课程《多层迭代法》
- 2016年：中国科学院大学研究生课程《多层迭代法》
- 2009年：宾州州立大学-北京大学本科生暑期学校《偏微分方程数值解法》
- 2009年：宾州州立大学本科生课程《微积分II》
- 2008年：宾州州立大学研究生课程《数值分析》
- 2008年：宾州州立大学-北京大学本科生暑期学校《偏微分方程数值解法》
- 2008年：宾州州立大学本科生课程《线性代数》
- 2007年：宾州州立大学本科生课程《微积分II》

开源软件项目：

- [AFEM@matlab](#): a Matlab package for adaptive finite element subroutines
- [FASP](#): a software package for high-performance auxiliary space preconditioners in C
- [OpenCAEPoro](#): a software package for multicomponent porous media flow in C++

专业组织任职：

- CSIAM油水资源数值模拟专业委员会，副主任（2016—）
- CSIAM高性能计算与数学软件专业委员会，委员（2021—2022）
- CSIAM数学与产业专业委员会，委员（2022—）
- 中国运筹学会优化软件与算法分会，副理事长（2023—）
- 中国流变学专委会，委员（2025—）
- 数值计算与计算机应用，编委（2021—）