YANFEI XIANG, Ph.D

University of Strasbourg, 7 rue René Descartes, 67084 Strasbourg Cedex, France
✉ yanfei.xiang@math.unistra.fr and yanfei.xiang@unistra.fr

EDUCATION

Cerfacs & Inria & University of Bordeaux, Bordeaux, France *Sep. 2019 - Dec. 2022*
Ph.D *Supervisors: Luc Giraud (Inria) and Paul Mycek (Cerfacs)*
Mathematics and Computer Science

University of Electronic Science and Technology of China, Chengdu *Sep. 2016 - June 2019*
Master of Science
School of Mathematical Sciences

Leshan normal University, Leshan, China *Sep. 2012 - June 2016*
Bachelor of Science
School of Mathematics and Information Sciences

RESEARCH INTERESTS

Generative models, Geometric deep learning, (Randomized) Numerical linear algebra, Iterative methods on CPUs and/or on GPUs, Scientific Machine Learning (SciML) for Partial Differential Equations (PDEs), Hybrid iterative methods and SciML for solving PDEs, SciML with uncertainty quantification methods for large-scale modeling and simulations.

WORK EXPERIENCES

Contract de recherche Post-Doctorant April. 1st, 2025 - Present
Post-Doctorant works at University of Strasbourg, France
Postdoctoral Project:
Generative models to enhance optimal control of a groups of PDEs and inverse problems

Modelling and Control team of IRMA, University of Strasbourg. Office: 308 de l'UFR, Strasbourg

Holiday Feb. 28th, 2025 - March 31st, 2025

Visiting guest at Cerfacs (Algo-Coop team) Dec. 1st, 2024 - Feb. 27th, 2025

Cooperation in numerical linear algebra, PDEs simulation, and scientific machine learning

Contract de recherche Post-Doctorant Inria Dec. 1st, 2023 - Nov. 30th, 2024
Post-Doctorant works at Inria - Centre de University of Bordeaux, France
Postdoctoral Project:
Hybridizing machine learning and numerical linear algebra for the wave and fluid simulations

Concace joint Inria team with Airbus Central R&T and Cerfacs, France. Office: G-20, Toulouse

Contract de recherche Post-Doctorant Inria Feb. 1st, 2023 - Nov. 30th, 2023
Post-Doctorant works at Inria - Centre de Paris, France
Postdoctoral Project:
Randomized methods for solving extreme-scale linear systems and computing eigenvalues and eigenvectors of matrices

Alpines team, France. Office: A327, Paris

Holiday Jan. 1st, 2023 - Jan. 31st, 2023

Contract de recherche Doctorale Inria Nov. 1st, 2019 - Dec. 31st, 2022
Doctorant works at Cerfacs, Inria - Centre de University of Bordeaux, France
Ph.D Thesis:
Solution of large linear systems with a massive number of right-hand sides and machine learning

Concace joint Inria team with Airbus Central R&T and Cerfacs, France. Office: B224, Bordeaux

PUBLICATIONS

[8] Luc Giraud, Carola Kruse, Paul Mycek, Maksym Shpakovych and **Yanfei Xiang** (in alphabetical author order). Neural network preconditioning: a case study for the solution of the parametric Helmholtz equation. *[Research Report], RR-9593, Inria Centre at the University of Bordeaux, 2025, pp.23*, https://hal.science/hal-05157038v1

[7] **Yanfei Xiang**. Randomized LOBPCG algorithm with linear dimension reduction. *[Research Report], Inria Centre at the University of Bordeaux, 2025, pp.33*, https://inria.hal.science/hal-04937938

[6] **Yanfei Xiang**. Unsupervised convolution neural operator preconditioning for the solution of some heterogeneous fluid PDEs. *[Research Report], Inria Centre at the University of Bordeaux, 2025, pp.43*, https://inria.hal.science/hal-04886933

[5] Luc Giraud and **Yanfei Xiang** (in alphabetical author order). A note on the partial convergence management for the solution of symmetric linear systems with multiple right-hand sides. *[Research Report], RR-9574, Inria Center at the University of Bordeaux, 2025, pp.27*, https://inria.hal.science/hal-04922247v1

[4] **Yanfei Xiang**. Solution of large linear systems with a massive number of right-hand sides and machine learning [*Ph.D thesis*]. Data Structures and Algorithms [cs.DS]. University of Bordeaux, 2022, https://theses.hal.science/tel-03967557

[3] Luc Giraud, Yan-Fei Jing, **Yanfei Xiang** (in alphabetical author order). A Block Minimum Residual Norm Subspace Solver with Partial Convergence Management for Sequences of Linear Systems. *SIAM Journal on Matrix Analysis and Applications, 2022, Vol. 43, Iss. 2, pp. 710-739*, https://doi.org/10.1137/21M1401127

[2] Luc Giraud, Yan-Fei Jing, **Yanfei Xiang** (in alphabetical author order). [1] A block minimum residual norm subspace solver for sequences of multiple left and right-hand side linear systems. *[Research Report] RR-9393, Inria Bordeaux Sud-Ouest, 2021, pp.60*, https://hal.inria.fr/hal-03146213v3

[1] **Yanfei Xiang**, Yan-Fei Jing, Ting-Zhu Huang. A New Projected Variant of the Deflated Block Conjugate Gradient Method. *Journal of Scientific Computing, 2019, Vol. 80, Iss. 2, pp. 1116-1138*, https://doi.org/10.1007/s10915-019-00969-4

You can find my published articles on the Google Scholar profile.

[1]Note that the authors contributed equally with alphabetical author order. I can declare my contribution if necessary.

ACADEMIC ACTIVITIES

Seminar Talk & Conference Presentations & Workshops

[12] (**Presentation in Workshop on Approximate Computing in Numerical Linear Algebra**) Mixed precision algorithms with neural operator preconditioning for solving some parametric PDEs, 7-10 Oct 2025, Paris, France

[11] (**Presentation in MS044 - Neural Operators for PDEs in Complex Geometries**) Convolution neural operator preconditioning for the solution of some heterogeneous PDEs. *Digital Twins in Engineering & Artificial Intelligence and Computational Methods in Applied Science (DTE - AICOMAS 2025), February 17-21, 2025, Paris, France*

[10] (**Seminar talk**) Neural operator preconditioning and neural network solvers for the solution of the parametric Helmholtz equations. *MACARON team, Strasbourg University, France, October 08, 2024*

[9] (**Poster**) Neural Network Preconditioned Subspace Methods for the Solution of the parametric Helmholtz Equation. *SciML2024. Strasbourg University, Strasbourg, France, July 8 - 12, 2024*

[8] (**Invited talk in Minisymposium MS85**) Neural Network Preconditioned Subspace Methods for the Solution of the parametric Helmholtz Equation. *SIAM Conference on Applied Linear Algebra (SIAM LA24), Sorbonne University, Paris, France, May 13 - 17, 2024* (Abstract and slides of this work are available at HAL Inria)

[7] Attend *Foundations of Computational Mathematics (FoCM 2023), Paris, France, June 12 - 21, 2023*

[6] (**Invited talk in Minisymposium MS110**) Hybridization of Machine Learning and Numerical Linear Algebra Techniques for Scientific Computing: Learned Minimum Residual Solvers for the Helmholtz Equations. *SIAM Conference on Computational Science and Engineering (SIAM CSE23), Amsterdam, The Netherlands, February 26 - March 3, 2023* (Abstract and slides of this work are available at HAL Inria)

[5] (**Invited talk in Minisymposium MS7**) A block minimum residual norm subspace solver with partial convergence management for sequences of linear systems. *27th International Conference on Domain Decomposition Methods, in MS7: Reusing information in iterative methods, Prague, Czechia, July 25-29, 2022*

[4] Hybridization of Machine Learning and Numerical Linear Algebra. *This presentation happened while my visiting to CERFACS, Toulouse, France, April 11-15, 2022*

[3] Visit to Toulouse to have discussions with researchers from ISAE-SupAero and Cerfacs for the scientific machine learning part of my Ph.D. thesis, *Toulouse, France, July 05-09, 2021*

[2] A block minimum residual norm subspace solver for sequences of multiple left and right-hand side linear systems. *The Algo-Coop seminar on Webex, CERFACS, Toulouse, France, March 3, 2021*

[1] On adaptive restart procedures for the breakdown-free block conjugate gradient method, *The 13th International Conference of China Matrix Theory and Its Application, Harbin Engineering University, Harbin, China, August 17-22, 2018*

Projects Sponsors include

[3] PEPR PDE-AI: Partial Differential Equations for Artificial Intelligence: numerical analysis, optimal control and optimal transport, a PEPR project funded by the ANR

[2] EMC2: Extreme-scale Mathematically-based Computational Chemistry project, ERC Syngergy Grant

[1] The updated version of *Fabulous* software that partially funded by the DGA through the Hi-Box project (partners: IMACS (PI), Airbus and Inria), https://gitlab.inria.fr/solverstack/fabulous/

Parts of online personal projects on Inria GitLab

[4] Neural operator learning (composed by deep neural networks (DNNs) and/or convolution neural networks (CNNs)) for the parametric Helmholtz equations: fgmres_olpre

[3] CNNs solver and operator learning for the Helmholtz equations: physics-informed deep learning solver for Helmholtz equation

[2] Partial convergence detection and subspace recycling for the block minimum residual norm subspace solver for large scale asymmetric problems: IB-BFGCRO-DR

[1] Partial convergence detection and deflated restarting for the block conjugate gradient solver for large scale symmetric problems: PDIBBCG

SKILLS

Software & Tools	Python, PyTorch, C, Matlab, TEX/LATEX, Linux Shell, Git, GitLab, HTML, CSS, JavaScript

LANGUAGES

English	IELTS 6 (obtained at 2019)
French	A2
Mandarin	Native language

INTERESTS

Reading, Composition (poem and short story), Cooking, Chinese Chess, Swimming, Pottery