Pawan Kumar

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Employment

Assistant Professor, 2017-now, IIIT, Hyderabad, India
Postdoc, 2014-2016, FU Berlin, Germany
Postdoc, 2013- 2014, Fraunhofer ITWM, Kaiserslautern, Germany Postdoc, Sept. 2011-July 2013, KU Leuven and exascience lab, Leuven, Belgium

Education

PhD (Highest honours ("très honorable" in French)), 2010, INRIA, France
MS, 2007, Indian Institute of Technology, Guawahati, India

Languages

English (Fluent), French (Intermediate), German (Beginner)

Computer Skills

Familiarity with: HPC programming: C, C++, Fortran 77/90, MPI, GPI (Global Address Space Programming, PGAS model) OpenMP, Cilk plus, C++-11 threads, Parallel analysis tools: Scalsca, TAU analysis tool, Vtune, Likwid, HDF5, Paraview, Web tools: XML, HTML, PHP, CSS, Version Control: SVN, GIT, Other Protyping tools: MATLAB, Octave, Maple, mexfile (Matlab, C, Fortran interface), Documentation: Latex

Numerical libraries used: FreeFEM++, UMFPACK, SuperLU, BLAS, Sparse BLAS, Goto BLAS, MKL (sparse and dense), PLASMA, METIS, ITSOL, pARMS, Peano (Grid traversal software) PETSc (basic), HYPRE, etc

Softwares created:

1. **COMPRE:** Fortran 77/90 codes for preconditioning structured PDE problems by combinative preconditioning (see the paper below)
2. **ADDS:** A class of parallel non-overlapping domain decomposition methods written in cilk plus suitable for shared memory architecture. A distributed memory variant is under construction

Operating Systems: Windows, Unix (preferred!)

Publications Reports

Optimization Methods in Machine Learning

- J. Naram, T. Sinha, P. Kumar, *On Riemannian approach for Constrained Optimization Problem in Extreme Classification*, COMAD 2021
- J. Naram, T. Sinha, P. Kumar, *A dual formulation for Tensor Completion Problem with Applications to Image and Video Completion*, WACV 2022.

Solvers for Computer Vision Problems:

- S. Das, S. Katyan, P. Kumar, *A Deflation Based Fast and Robust Preconditioner for Bundle Adjustment*, accepted in WACV 2021.
- S. Katyan, S. Das, P. Kumar, *Multigrid Preconditioned Solver for Bundle Adjustment*, accepted in WACV 2020.
- S. Das, S. Katyan, P. Kumar, *Domain Decomposition Based Preconditioned Solver for Bundle Adjustment*, accepted in NCVPRIPG 2019.

On Preconditioners/Linear Solvers:

- P. Kumar, *Fast Preconditioned Solver for Truncated Saddle Point Problem in Nonsmooth Cahn–Hilliard Model*, Book chapter, Recent Advances in Computational Optimization, 2016
- P. Kumar, L. Grigori, F. Nataf, and Q. Niu, *Combination preconditioning based on relaxed nested factorization and tangential filtering decomposition*, International Journal of Computer Mathematics, 2015, doi:10.1080/00207160.2014.998208
- P. Kumar, *Aggregation based on graph matching and inexact coarse grid solve for algebraic multigrid*, accepted, Int. J. Comp. Math., 2013, http://dx.doi.org/10.1080/00207160.2013.821115

On Fourier Analysis

- Q. Niu, L. Grigori, P. Kumar, and F. Nataf, *Modified tangential frequency filtering decomposition and its Fourier analysis*, Numerische Mathematik, Volume 116, issue 1, p 123-148, 2010, doi: 10.1007/s00211-010-0298-3

On High Performance Computing/Scientific Computing

- A. Aggarwal, S. Kakkar, P. Kumar, *A fast parameter free solver for structured grid problems*, short paper, SC 2021
- S. Rampalli, N. Sehgal, I. Bindlish, T. Tyagi, *Efficient FPGA Implementation of Conjugate Gradient Methods for Laplacian System using HLS*, short paper, FPGA 2019
- P. Kumar, *Multilevel Communication Optimal Least Squares Solver*, IEEE proceedings, International Conference on Computational Sciences, ICCS, vol. 51, p. 1838-1847, 2015, doi: 10.1016/j.procs.2015.05.410
- P. Kumar, *Communication Optimal Least Squares Solver*, accepted, IEEE proceedings, 16th international conference on high performance computing and communications, HPCC, 20-22 August 2014, Paris, France
- P. Kumar, *Multi-threaded direction preserving preconditioners*, IEEE proceedings, 13th international symposium on parallel and distributed computing, ISPDC, 23-27 June 2014, p. 148-153, Marseille (Porquerolles island), France
- P. Kumar, S. Markidis, G. Lapenta, K. Meerbergen, D. Roose, *High Performance Solvers for Implicit Particle in Cell Simulation*, ICCS, vol. 18, Procedia Computer Science, pp 2396-2405, 2013, http://dx.doi.org/10.1016/j.procs.2013.05.396
- P. Kumar, K. Meerbergen, and D. Roose, *Multi-threaded nested filtering factorization preconditioner*, vol. 7782, LNCS, pp. 220-234, 2013

Reports under submission

- P. Kumar, L. Grigori, Q. Niu, F. Nataf, *Fourier analysis of Modified Nested Factorization Preconditioner for Three-Dimensional Isotropic Problems*, HAL, INRIA report, 2019.

- L. Grigori, P. Kumar, F. Nataf, and K. Wang, *A class of multilevel parallel preconditioners*, submitted as INRIA tech. report no. 7410, available online at: `http://hal.archives-ouvertes.fr/docs/00/52/41/10/PDF/Paper.pdf`

Grants

- MPAG: Microsoft Academic Partnership Grant
- IHUB Grant: Optimization Methods for Healthcare and Transportation
- Ripple Center of Excellence: Distributed Optimization and Blockchain
- INAE Travel grant
- MATRICS grant: Solvers for saddle point problems
- ERCIM Marie Curie Actions Fellowship: High performance computing

Awards

- Marie-Curie ERCIM fellowship for independent postdoctoral research, 2013-2014
- European CORDIS scholarship (applied by Supervisor) for PhD studies at INRIA, Saclay, 2007-2010
- Secured a percentile of 97 (rank 88/2500) in all India applied Mathematics category in GATE (Graduate Aptitude Test in Engineering, India), 2007
- Junior summer research scholarship from JNCASR Bangalore, India to conduct undergraduate research for two months, 2005
- Certificate of excellence for 3rd rank in Mathematics department in north eastern hills university in 2005

Teaching

- Monsoon 2021
  - Topics in Applied Optimization
  - Probability and Statistics
- Spring 2021
  - Advanced Optimization
- Monsoon 2020
  - Discrete Structures
  - Probability and Statistics
- Spring 2020
  - Introduction to Parallel Scientific Computing
- Monsoon 2019
  - Topics in Applied Optimization
  - Discrete Structures
- Spring 2019
  - Introduction to Parallel Scientific Computing
  - Topics in Optimization on Manifolds
- Monsoon 2018
  - Discrete Structures
  - Topics in Applied Optimization
- Spring 2018

  - Introduction to Parallel Scientific Computing
  - Linear Algebra 2018
- Monsoon 2017
  - Discrete Mathematics and Algorithms
  - Algorithms
- Spring 2017
  - Introduction to Parallel Scientific Computing

Proposal accepted

Scalable robust Schur complement preconditioners using PGAS (performed under ERCIM fellowship), accepted and completed under MArie-Curie Fellowship at Fraunhofer ITWM.

Talks

- *Multilevel Communication Optimal Least Squares Solver*, HPCC, 1-3 June 2015, Reykjavic, Iceland
- *High Performance Solvers for Implicit Particle in Cell Simulations*, ICCS, 5-7 June 2013, Barcelona, Spain
- *Multi-threading and auto-vectorization for direction preserving preconditioners*, SIAM conference on Computational Science and Engineering, 25 February - 1 March 2013, Boston, USA
- *Parallel aggregation based algebraic multigrid*, International Conference on Domain Decomposition, 25-29 June 2012, Rennes, France
- *Purely algebraic domain decomposition methods for the incompressible Navier-Stokes equation*, SIAM LA, 18-22 June 2012, Valencia, Spain
- *Multithreaded row and column sum based preconditioners*, PARA 10-13 June 2012, Helsinki, Finland
- *Purely algebraic domain decomposition methods for the incompressible Navier-Stokes equation*, Workshop on Recent Developments in the Solution of Indefinite Systems, April 17, 2012, Eindhoven, The Netherland
- *Combination preconditioning based on relaxed nested factorization and tangential filtering preconditioner*, IHP, 2008, Paris, France
- *Gershgorin circles and Poincare separates*, ESS sem. series, KU Leuven, Belgium

Visits Schools Workshops

- *Research visit (Prof. M. Gander) University of Geneva, Geneva*, 2-6 June 2014
- *Research visit (Prof. A. Napov) Universite Libre de Bruxelles*, 7-11 April 2014
- *Winter school on Hierarchical matrices*, Leipzig, Germany, 2014
- *Visit Lawrence Berkeley National Lab.:*, 4th March 2013, Berkeley, California
- *Ninth VI-HPS Tuning Workshop*, 23-27 April 2012, St-Quentin-en-Yvelines, France
- *INRIA school on solution of large sparse linear systems*, Sophia-antipolis, France, 2008
- *Winter school on Hierarchical matrices*, Leipzig, Germany, 2008
- *Workshop on FreeFEM++*, 14-15 September, 2009, IHP, Paris, France

Hobbies

- Playing chess, biking, travelling and cooking