

Amit N Subrahmanya

PH.D. CANDIDATE · CS DEPT AT VIRGINIA TECH

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Education

Virginia Tech

PH.D. IN COMPUTER SCIENCE (ONGOING), 3.8 GPA, ADVISED BY PROF. ADRIAN SANDU

Blacksburg, VA, USA

August 2019 - present

R.V. College of Engineering

BACHELOR OF ENGINEERING IN COMPUTER SCIENCE, 9.1/10 GPA

Bengaluru, India

August 2015 - May 2019

Research Interests

Data assimilation, inverse problems, experimental design, uncertainty quantification, state/parameter estimation, (randomized) numerical linear algebra, high-performance computing, numerical methods for ODEs/PDEs, optimization, science-guided machine learning.

Professional Experience

Virginia Tech

GRADUATE RESEARCH ASSISTANT, WITH PROF. ADRIAN SANDU

Blacksburg, VA, USA

2020 - present

- Along with various collaborators, we worked on deriving generic, parametric, stochastic particle flows for both filtering and smoothing (with and without model errors) applications for high-dimensional data assimilation. We developed a linearly implicit time-stepping method to efficiently evolve the stiff particle flows. We also developed regularization heuristics to prevent particle collapse.
- We extend the above framework to account for systems with non-linear equality constraints by posing the flow as a stochastic differential algebraic equation and evolving this dynamic. This can be further extended to incorporate inequality and box constraints based on necessity.
- We are working on a particle filter to sample states directly from scalar conditional distributions.
- We are exploring feature-preserving data assimilation for compressible flows where features include shocks and discontinuities across the states.

Argonne National Laboratory

GIVENS ASSOCIATES, WITH DR. VISHWAS RAO

Lemont, IL, USA

Summer 2024

- Along with various collaborators, we worked on optimal experimental design (specifically sensor placement) for non-linear problems. We extend a previous work by my collaborators (from a linear to a non-linear setting) where sensor choice comes from selecting the most independent columns from a factor of the Fisher information matrix.

Argonne National Laboratory

GIVENS ASSOCIATES, WITH DR. VISHWAS RAO

Lemont, IL, USA

Summer 2023

- Along with various collaborators, we worked on building and testing highly parallel, low-rank, matrix-free randomized preconditioners to accelerate the solution of the strong constraint 4DVar problem. We developed a heuristic to adaptively decide the rank of the said preconditioner based on the conditioning of the linear system being solved.
- We worked on a software package in Julia for efficient subset selection methods.

Argonne National Laboratory

GIVENS ASSOCIATES, WITH DR. VISHWAS RAO

Lemont, IL, USA

Summer 2022

- Along with various collaborators, we developed a methodology to detect and capture droughts from Standardized VPD Drought Index data using a bi-level clustering approach based on modified k-means and DBSCAN.

Virginia Tech

GRADUATE TEACHING ASSISTANT

Blacksburg, VA, USA

2019 - present

- I have been a teaching assistant for the courses Formal Languages and Automata Theory, Theory of Computation, and Advanced Parallel Computation. My duties involved grading assignments and answering questions in my office hours.
- I have also led a few classes for the Advanced Parallel Computation course, substituting for the professor.

Organizational Experience

SIAM CSE 2025. Co-organizer of a planned MS on non-linear data assimilation.

SIAM CSE 2023. Co-organizer of MS201 Recent Advances in Data Assimilation and Uncertainty Quantification.

SIAM UQ 2022. Co-organizer of MS101, Novel Approaches in Variational Particle Filtering.

Publications

PUBLISHED

Andrey A Popov, **Amit N Subrahmanya**, Adrian Sandu. 2020. A Stochastic Covariance Shrinkage Approach to Particle Rejuvenation in the Ensemble Transform Particle Filter. *Nonlinear Processes in Geophysics Discussions* (2021): 1-14.

Anala M.R. **Amit N Subrahmanya**, Allbright D'Souza. 2018. Performance Analysis of Mesh-based NoC's on Routing Algorithms. *International Journal of Electrical and Computer Engineering* 8 (5), 3368.

IN REVIEW

Amit N Subrahmanya, Andrey A Popov, Adrian Sandu. 2021. An Ensemble Variational Fokker-Planck Method for Data Assimilation. arXiv preprint arXiv:2111.13926.

Amit N Subrahmanya, Vishwas Rao, Arvind K Saibaba. 2023. Randomized preconditioners for SC4DVAR. arXiv preprint arXiv:2401.15758.

Amit N Subrahmanya, Andrey A Popov, Reid Gomillion, Adrian Sandu. 2024. Constraint preserving filters for data assimilation. arXiv preprint arXiv:2405.04380.

IN PREPARATION

Amit N Subrahmanya, Julie Bessac, Andrey A Popov, Adrian Sandu. 2024. A marginal coupling approach to data assimilation.

Tiffany Christian, **Amit N Subrahmanya**, Brandi Gamelin, Vishwas Rao, Noelle I Samia, Julie Bessac. 2024. A bi-level clustering approach for the spatiotemporal analysis of droughts.

Amit N Subrahmanya, Srinivas Eswar, Vishwas Rao, Arvind K Saibaba. 2024. Optimal experimental design for non-linear problems using column subset selection.

Presentations

Summer Argonne Students Symposium (SASSy) 2024. OED for non-linear problems using CSSP.

SIAM AN 2024. Constraint preserving particle flow filters, MS66.

AMS SESM 2024. Randomized preconditioners for SC-4DVAR.

SIAM TXLA 2023. Randomized preconditioners for SC-4DVAR, MS10.

Summer Argonne Students Symposium (SASSy) 2023. Randomized preconditioners for SC-4DVAR.

SIAM SEAS 2023. Constraint preserving particle flow filters, MS01.

SIAM CSE 2023. Constraint preserving particle flow filters, MS414.

Summer Argonne Students Symposium (SASSy) 2022. A bi-level clustering approach for drought analysis.

SIAM UQ 2022. An ensemble variational Fokker-Planck method, MS101.

SIAM CSE 2021. A Variational Particle Flow Filter, MS332.

Posters

CELS Student Poster Session 2024, Argonne, OED for non-linear problems using CSSP.

WCRP-WWRP Symposium on Data Assimilation and Reanalysis 2021. A variational particle filter.

HiPC SRS 2017, Performance Analysis of Mesh-based NoC's on Routing Algorithms.

Awards & Fellowships

2024	SIAM Student Travel Award for SIAM AN24, Society for Industrial and Applied Mathematics	\$650
2013-2019	National Talent Search Examination Scholar, National Council of Educational Research and Training	

Skills

RELEVANT COURSEWORK

Numerical Linear Algebra, Data Analytics, Approximation Theory, Advanced Parallel Computation, Finite Difference Methods, Science Guided Machine Learning, Time Integration, Optimization, Computational Data Assimilation, Inverse Problems.

PROGRAMMING LANGUAGES

MATLAB (expert), Python, Julia, C, C++, Java.