

VIKRAM V. GARG

vikram.v.garg@gmail.com

<https://vikramvgarg.github.io/>

SUMMARY

I am an applied mathematician with a track record of high-quality publications and advanced software development in computational modeling and statistics. I have experience in developing reliable, state-of-the-art algorithms and solvers for problems in simulation and data assimilation.

AREAS OF EXPERTISE

Simulation Algorithms & Infrastructure, Software Design & Development, Statistical Sampling & Experimental Design

RESEARCH & DEVELOPMENT EXPERIENCE

libMesh, a C++ Finite Element library (libmesh.github.io) September 2017 - Present
Simulation Algorithm & Software Developer

- Led a multiyear software design and engineering project to add pioneering, comprehensive adjoint (high dimensional, automatic derivative) capability in a widely used C++ simulation platform.
- Developed verifiable adjoint-based algorithms (mesh adaptation, high dimensional gradient calculation) for solving simulation and variational data assimilation problems.
- Developed stable mathematical formulations for problems where adjoint computation was ill-posed/unstable.
- Community Impact: libMesh adjoint infrastructure used in higher level optimization libraries, doctoral research and top-tier publications.

Relevant artefacts:

- Implementing Generalized Adjoint Capabilities in libMesh, 14th USNCCM, 2017
- Software example suite demonstrating adjoint-based derivative calculation, mesh and model refinement.
- Local Enhancement of Functional Evaluation and Adjoint Error Estimation for Variational Multiscale Formulations, Computer Methods in Applied Mechanics & Engineering, 2019.

Massachusetts Institute of Technology, then UT Austin September 2012 - August 2017
Postdoctoral Associate

- Developed new multimodel inference/optimization algorithms for source detection in subsurface flow.
- Developed highly accurate numerical methods to incorporate complex constraints in simulation and optimization algorithms.
- Developed turbulent flow solver for high speed aerodynamic analysis using adaptive mesh refinement and adjoint automatic differentiation.
- Developed experimental design methods for ocean data acquisition trajectories using high dimensional spatial statistics (R-INLA).

Relevant artefacts:

- Model Adaptivity for Goal-Oriented Inference using Adjoints, Computer Methods in Applied Mechanics & Engineering, 2018.
- Enhanced Functional Evaluation for the Penalty Finite Element Method, Computers & Mathematics with Applications, 2019.
- Towards Forward Propagation of Reynolds Stress Model Uncertainty, 13th USNCCM, 2015.
- Spatial Statistics based Prior Generation for Bayesian Experimental Design.

INDUSTRY EXPERIENCE

Esgee Technologies

February 2019 - March 2020

Member of the Technical Staff

- Developed turbulent and swirl flow modeling capability in commercial multiphysics simulation software.
- Mentoring and onboarding of new PhD hires via flow solver training and code development exercises.

OTHER PUBLICATIONS & CONFERENCE PRESENTATIONS

Statistics & Experimental Design

- *Hierarchical Latin Hypercube Sampling*, **V.V. Garg**, R. Stogner, Journal of the American Statistical Association, 1-10, 2017.
- Minimum Local Distance Density Estimation, **V.V. Garg**, L. Tenorio, K. Willcox, Communications in Statistics: Theory and Methods, 2017.
- *Local Sensitivity Derivative Enhanced Monte Carlo*, **V.V. Garg**, R. Stogner, SIAM Conference on Computational Science and Engineering, Boston, 2013.

Computational Modeling & Numerical Analysis

- *Adjoint Consistent Formulations for Coupled Electroosmotic Flow Systems*, **V.V. Garg**, S. Prudhomme, K.G. van der Zee, G.F. Carey, Advanced Modeling and Simulation in Engineering Sciences, 2:15, 2014.
- *Flux evaluation in primal and dual boundary-coupled problems*, E.H. van Brummelen, K.G. van der Zee, **V.V. Garg**, S. Prudhomme, Journal of Applied Mechanics, 79.1 (2012): 010904

EDUCATION

The University of Texas at Austin

PhD, Computational and Applied Mathematics, August 2012

Graduate School Continuing Fellowship, 2011-2012

Thesis: Coupled Flow Systems, Adjoint Techniques & Uncertainty Quantification

The University of Texas at Austin

Bachelor of Science, Aerospace Engineering, May 2007

Bachelor of Science, Pure Mathematics, May 2007

GPA: 3.97/4.00

PROFESSIONAL SERVICE

- Co-organized mini-symposium “Adjoint in Computational Software” at USNCCM 2017.
- Reviewer for ‘SIAM Journal on Scientific Computing’, ‘Computers & Mathematics with Applications’, ‘Numerische Mathematik’ and ‘Journal of Statistical Planning and Inference’.

REFERENCES

Dr. Karen Willcox

Director, Institute for Computational & Engineering Sciences

The University of Texas at Austin

kwillcox@ices.utexas.edu

Dr. Serge Prudhomme

Professor, Department of Mathematical & Industrial Engineering

Ecole Polytechnique Montreal

serge.prudhomme@polymtl.ca

Dr. Roy Stogner

Research Associate, Institute for Computational & Engineering Sciences

The University of Texas at Austin

roystgnr@ices.utexas.edu

Visa Status: U.S. Permanent Resident.