Umberto Emanuele Villa

Contact Information

Washington University in St. Louis
Electrical & Systems Engineering
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Research Highlights

My research interest focuses on the numerical simulation of physical problems of practical relevance in various fields of engineering, including porous media flow, petroleum industry, electromagnetism, thermodynamics, fluid-dynamics, and solid mechanics.
My areas of expertise include numerical methods for partial differential equations (PDE), high performance computing, finite element analysis, numerical linear algebra, algebraic multigrid, numerical upscaling, PDE constrained optimization, uncertainty quantification and fluid-dynamics.

Education

Emory University, Atlanta, GA (United States)
PhD in Computational Mathematics **2012**

Politecnico di Milano, Milan (Italy) & **Politecnico di Torino**, Turin (Italy)
ASP diploma - Alta Scuola Politecnica **2008**

Politecnico di Milano, Milan (Italy) & **Politecnico di Torino**, Turin (Italy)
Dual Master's degree in Mathematical Engineering, cum laude **2007**

Politecnico di Milano, Milan (Italy)
Bachelor's degree in Mathematical Engineering, cum laude **2005**

Employment

Washington University in St. Louis, St. Louis, MO
Electrical & System Engineering
Research Assistant Professor **2018 –**

University of Texas at Austin, Austin, TX
The Institute for Computational Engineering and Science
Research Associate **2015 – 2018**

Lawrence Livermore National Laboratory (LLNL), Livermore, CA
Center for Applied Scientific Computing
Visiting Scientist **2015 –**
Postdoctoral Fellowship **2013 – 2015**
Student Internship **Summers 2011 & 2012**

Oak Ridge National Laboratory (ORNL), Oak Ridge, TN
Computer Science and Mathematics division
Student Internship **Summers 2009 & 2010**

Honors and Awards

Best Student Paper Award, Copper Mountain Conference, Copper Mountain, Colorado, US **2012**

Medal for best graduate recipient, Politecnico of Milano, Milan, Italy **2005**

Invited to participate to the national (Italian) phase of the International Mathematical Olympiad, Cesenatico, Italy **2001**

Grants and Contracts

O. Ghattas (PI) and U. Villa (Co-PI), *Collaborative Research: SI2-SSI: Integrating Data with Complex Predictive Models under Uncertainty: An Extensible Software Framework for Large-Scale Bayesian Inversion*, National Science Foundation, Division of Advanced Cyberinfrastructure, Grant ACI-1550593, 09/01/1608/31/19, $350,885. A collaborative research project with N. Petra (UC-Merced) and Y. Marzouk and M. Parno (MIT) with total funding of $1.35M.

0. Ghattas, Y. Marzouk, M. Parno, N. Petra, G. Stadler, and U. Villa, *2018 Gene Golub SIAM*

Summer School entitled *Inverse Problems: Systematic Integration of Data with Models under Uncertainty*, $109,200 funding from SIAM.

U. Villa (PI) and N. Petra (Co-PI), Cloud computing resources for the *2018 Gene Golub SIAM Summer School* entitled *Inverse Problems: Systematic Integration of Data with Models under Uncertainty*, XSEDE educational allocation TG-DMS180009, 60,000 CPU hours.

Scholarships

Laney Graduate School Scholarship, Emory University, Atlanta, GA **2008 – 2012**
Alta Scuola Politecnica Scholarship, Politecnico of Milano, Milan, Italy, **2005 – 2007**

Research Experience

Washington University in St. Louis, St. Louis, MO **2018 –**
Investigation of variational Bayesian inference methods for medical imaging, photoacustic tomography; scalable numerical methods for uncertainty quantification and inverse problems.

University of Texas at Austin, Austin, TX **2015 – 2018**
Investigation of scalable numerical methods for uncertainty quantification, inverse problems, PDE-constrained optimization, optimization under uncertainty, optimal design of experiments, model inadequacy.
Application of end-to-end uncertainty quantification techniques to subsurface flow, turbulent flow, combustion, biological tissues mechanics, ice-ocean interaction and wave propagation problems.
Development of a Python/FEniCS toolbox for deterministic and Bayesian inverse problems, uncertainty quantification and propagation.
Preparation of proposals, annual reports, and final research reports to government agencies, industry, universities.
PI: Prof. Omar Ghattas (Institute for Computational Engineering and Sciences - ICES).
Projects:

- *Integrating Data with Complex Predictive Models under Uncertainty: An Extensible Software Framework for Large-Scale Bayesian Inversion*, National Science Foundation, Division of Advanced Cyberinfrastructure, Ghattas (PI), myself (Co-PI).
- *Bayesian Optimal Experimental Design for Inverse Scattering*, Air Force Office of Scientific Research, Computational Mathematics program, O. Ghattas (PI), G. Biros and Y. Marzouk (Co-PIs); role: research scientist.
- *Inference, Simulation, and Optimization of Complex Systems Under Uncertainty: Theory, Algorithms, and Applications to Turbulent Combustion*, Defense Advanced Research Projects Agency, EQUiPS program, O. Ghattas (PI), R. Moser, G. Biros, K. Willcox, M. Heinkenschloss, A. Stuart, M. Girolami, A. Philpott (Co-PIs), role: research scientist.
- *Large-scale Inverse Problems and Uncertainty Quantification for Reservoir Modeling*, Joint ExxonMobil-UT Energy Institute Project, O. Ghattas (PI), G. Biros, T. Bui-Thanh, C. Dawson (Co-PIs), role: research scientist.

Lawrence Livermore National Laboratory (LLNL), Livermore, CA **2011 – 2015**
Investigation of highly parallel and scalable numerical solvers for mixed finite element discretizations: element agglomeration algebraic multigrid (AMGe), numerical upscaling.
Hybrid MPI/OPENMP implementation of scalable and efficient numerical solver for mixed finite elements discretizations based on AMGe techniques.
Investigation of stochastic models for subsurface flow problems: multilevel acceleration of Monte Carlo methods by using algebraically constructed coarse spaces (upscaled discretizations).
Development and parallel c++ implementation of stable and robust finite element discretizations and efficient solvers for oil reservoir simulation.
Mentor: Dr. Panayot Vassilevski (Center for Applied Scientific Computing - CASC).
Projects:

- *Towards Optimal Order Resilient Solvers at Extreme Scale (TOORSES)*, DOE Office of Advanced Scientific Computing Research, X.-S. Li (lead PI), P. Vassilevski (LLNL PI), role: postdoctoral researcher.
- *Scalable Multilevel UQ Concepts for Extreme-Scale Multiscale Problems*, DOE Office of Advanced Scientific Computing Research, Y. Efendiev (lead PI), P. Vassilevski (LLNL PI), role: postdoctoral researcher.
- *Adaptive Dimension Reduction via Coarsening and Multilevel Solvers*, DOE Office of Advanced

Scientific Computing Research, P. Vassilevski (PI), role: postdoctoral researcher.

Oak Ridge National Laboratory (ORNL), Oak Ridge, TN **2009 – 2010**
Development of a general optimization-based framework for multiphysics multimodel Domain Decomposition.
Application of the multi-physics framework to conjugate heat transfer and fluid structure interaction problems.
Mentor: Dr. Judith Hill (Computer Science and Mathematics division of ORNL).

Emory University, Atlanta, GA **2008 – 2012**
Analysis and implementation of a new time-adaptive algorithm for the solution of the unsteady Navier-Stokes equations.
Development of parallel and scalable block preconditioners for saddle point problems.
Application of these new numerical methods to patient specific blood flow simulations with the aim to numerically investigate pathological or clinical flow conditions (e.g. formation of aneurysms in the carotid artery, design of left ventricle assisting devices).
Development of software to analyze bouted accelerometer data for physical activity studies (collaboration with D. Salvo Dominguez and M. Pratt).
PhD Advisor: Prof. Alessandro Veneziani.

Teaching Experience

University of Texas, Austin, TX

Instructor of the *2018 Gene Golub SIAM Summer School* on *Inverse Problems: Systematic Integration of Data with Models under Uncertainty*, June 17-30, 2018, Breckenridge, Colorado, USA (taught jointly with O. Ghattas, Y. Marzouk, M. Parno, G. Stadler)

Co-instructor for graduate course
"Computational & Variational Inverse Problems" (Prof. Ghattas) **Fall 2017**

Guest lecturer for the graduate level courses
"Finite Element Method in Geophysics" (Prof. Ghattas) **Fall 2016**

- 09/23/2016: Finite element discretization of the 1D Poisson equation using FEniCS
- 10/7/2016: Equivalence between energy formulation and boundary value problem formulation for self-adjoint operators; A numerical illustration of finite element solution convergence rates
- 11/18/2016: Finite element discretization of the 2D Poisson equation using FEniCS

"Computational & Variational Inverse Problems" (Prof. Petra, UC Merced) **Fall 2015**

- 11/17/2015: Numerical solution of the advection-diffusion source inverse problem using conjugate gradient method.

"Computational & Variational Inverse Problems" (Prof. Ghattas) **Fall 2015**

- 10/14/2015: Introduction to the FEniCS library for finite element solution of boundary value problems posed in weak form
- 10/28/2015: Numerical solution of inverse problems governed by PDEs using steepest descent
- 11/09/2015: Numerical solution of the Poisson log conductivity inversion problem using the inexact Newton-conjugate gradient method
- 11/16/2015: Numerical study of the spectral properties of the Hessian operator for an advection-diffusion source inverse problem

Emory University, Atlanta, GA

Instructor for undergraduate courses in Calculus I and II **2011 – 2012**
Calculus II (Teaching mentor: Prof. Gould) **Spring 2012**
Calculus I (Teaching mentor: Prof. Garibaldi) **Fall 2011**

Calculus II (Teaching mentor: Prof. Batterson)	**Spring 2011**
Teaching Assistant for undergraduate courses in Life Science Calculus I and II	**2008 – 2010**
Life Science Calculus I (Lab instructor for Prof. Duffus)	**Fall 2010**
Life Science Calculus II (Lab instructor for Prof. Duffus)	**Spring 2010**
Life Science Calculus I (Lab instructor for Prof. Duffus)	**Fall 2009**
Life Science Calculus II (Grader for Prof. Duffus)	**Spring 2009**
Life Science Calculus II (Grader for Prof. Duffus)	**Spring 2008**
Life Science Calculus I (Grader for Prof. Duffus)	**Fall 2008**

Mentoring Experience

University of Texas at Austin, Austin, TX **2015 –**

PhD students co-advised (adviser: O. Ghattas):
Tom O'Leary-Roseberry (2015 –), dissertation topic: inversion for coupled ice-ocean interaction.
Joshua Chen (2016 –), dissertation topic: Bayesian inference of material properties of cardiac tissue from experimental data.

Master students co-supervised (supervisor: O. Ghattas):
Di Liu (CSEM), *hIPPYLearn: An inexact Stochastic Newton-CG method for training neural networks*, 2017.
Ge Gao (CSEM), *hIPPYLearn: An inexact Newton-CG method for training neural networks with analysis of the Hessian*, 2017.

Undegraduate students co-mentored (mentor: O. Ghattas):
Bassel Saleh (Moncrief Undergraduate Summer Internship), *Neural Networks as Surrogate Models for Forward and Inverse Problems*, 2016.

Informal mentoring:
Trained several graduate students in using the hIPPYlib software to solve inverse problem: A. Alghamdi and B. Crestel (ICES, adviser O. Ghattas), S. Wahal (ICES, adviser G. Biros), and K. McCormack (Jackson School of Geosciences, adviser M. Hesse).
Provided a detailed introduction to the finite element method and the FEniCS software to Samuel Estes (Ph.D student, adviser C. Dawson).

Lawrence Livermore National Laboratory (LLNL), Livermore, CA **2013 – 2015**
PhD students intern supervised (mentor: P. Vassilevski):
M. Christensen (Technical University of Denmark, summers 2013 and 2014): mixed finite element methods and numerical upscaling with application to subsurface flow and petroleum engineering.
S. Ladenheim (Temple University, summer 2013): generation of Gaussian random field by solving stochastic PDEs
D. Emerson (Tufts University, summer 2013): nonlinear multilevel methods
C. S. Lee (Texas A& M, summer 2014): spectral upscaling method for mixed formulation of Darcy equation.

Publications

Peer-Reviewed Journal Articles

S. Osborn, P. Zulian, T. Benson, U. Villa, R. Krause, and P. Vassilevski. "Scalable hierarchical PDE sampler for generating spatially correlated random fields using non-matching meshes". *Numerical Linear Algebra with Applications*, 25(3):e2146, 2018.

N. Alger, U. Villa, T. Bui-Thanh, and O. Ghattas. "A data scalable augmented Lagrangian KKT preconditioner for large scale inverse problems". *SIAM Journal on Scientific Computing*, 39(5):A2365–A2393, 2017.

P. Chen, U. Villa, and O. Ghattas. "Hessian-based adaptive sparse quadrature for infinite-dimensional Bayesian inverse problems". *Computer Methods in Applied Mechanics and Engineering*, 327:147–172, 2017.

M. Christensen, P. S. Vassilevski, and U. Villa. "Nonlinear Multigrid solvers exploiting AMGe coarse spaces with approximation properties". *Journal of Computational and Applied Mathematics*, available on-line, 2017.

M. Christensen, U. Villa, A. Engsig-Karup, and P. S. Vassilevski. "Numerical upscaling for incompressible flow in reservoir simulation: an element-based algebraic multigrid (AMGe) approach". *SIAM Journal on Scientific Computing*, 39(1):B102–B137, 2017.

S. Guzzetti, T. Passerini, J. Slawinski, U. Villa, A. Veneziani, and V. Sunderam. "Platform and algorithm effects on computational fluid dynamics applications in life sciences". *Future Generation Computer Systems*, 67:382 – 396, 2017.

S. Osborn, P. S. Vassilevski, and U. Villa. "A Multilevel Hierarchical Sampling Technique for Spatially Correlated Random Fields". *SIAM Journal on Scientific Computing*, 39(5):S543–S562, 2017.

D. Kalchev, C. S. Lee, U. Villa, Y. Efendiev, and P. S. Vassilevski. "Upscaling of mixed finite element discretization problems by the spectral AMGe method". *SIAM Journal on Scientific Computing*, 38(5):A2912–A2933, 2016.

D. Salvo, C. Torres, U. Villa, J. A. Rivera, O. L. Sarmiento, R. S. Reis, and M. Pratt. "Accelerometer-based physical activity levels among Mexican adults and their relation with sociodemographic characteristics and BMI: a cross-sectional study". *Int. J. Behavioral Nutrition and Physical Activity*, 12(79):1–11, 2015.

P. S. Vassilevski and U. Villa. "A mixed formulation for the Brinkman problem". *SIAM Journal on Numerical Analysis*, 52(1):258–281, 2014.

K. W. Desmond, U. Villa, M. Newey, and W. Losert. "Characterizing the rheology of fluidized granular matter". *Physical Review E*, 88(3):032202, 2013.

T. Passerini, A. Quaini, U. Villa, A. Veneziani, and S. Canic. "Validation of an open source framework for the simulation of blood flow in rigid and deformable vessels". *Int. J. Numerical Methods in Biomedical Engineering*, 29(11):1192–1213, 2013.

P. S. Vassilevski and U. Villa. "A block-diagonal algebraic multigrid preconditioner for the Brinkman problem". *SIAM Journal on Scientific Computing*, 35(5):S3–S17, 2013.

A. Veneziani and U. Villa. "ALADINS: An ALgebraic splitting time ADaptive solver for the Incompressible Navier–Stokes equations". *Journal of Computational Physics*, 238:359–375, 2013.

Peer-Reviewed Conference Papers

M. Neumüller, P. S. Vassilevski, and U. Villa. *Space-time constrained First Order Systems Least Squares (CFOSLS) with AMGe upscaling*, pages 253–260. Springer, 2017.

M. Christensen, U. Villa, and P. S. Vassilevski. "Multilevel techniques lead to accurate numerical upscaling and scalable robust solvers for reservoir simulation". In *SPE Reservoir Simulation Symposium*. Society of Petroleum Engineers, 2015.

T. Passerini, J. Slawinski, U. Villa, and V. Sunderam. "Experiences with Cost and Utility Tradeoffs on IaaS Clouds, Grids, and On-Premise Resources". In *Proc. IEEE Intl. Conference on Cloud Engineering (IC2E) - Cloud Analytics Workshop*, pages 391–396. IEEE, 2014.

J. Slawinski, U. Villa, T. Passerini, A. Veneziani, and V. Sunderam. "Issues in Communication Heterogeneity for Message-Passing Concurrent Computing". In *27th IEEE Intl. Parallel and Distributed Processing Symposium Workshops & PhD Forum (IPDPSW)*, pages 93–102. IEEE, 2013.

J. Slawinski, U. Villa, T. Passerini, A. Veneziani, and V. Sunderam. "Experiences with Target-Platform Heterogeneity in Clouds, Grids, and On-Premises Resources". In *26th IEEE Intl. Parallel and Distributed Processing Symposium Workshops & PhD Forum (IPDPSW)*, pages 41–52. IEEE, 2012.

Submitted Manuscripts

P. Chen, U. Villa, and O. Ghattas. "Taylor approximation and variance reduction for PDE-constrained optimal control under uncertainty". 2018.

P. Chen, U. Villa, and O. Ghattas. "Taylor approximation for PDE-constrained optimization under uncertainty: Application to turbulent jet flow", 2018.

B. Kramer, A. N. Marques, B. Peherstorfer, U. Villa, and K. Willcox. "Multifidelity probability estimation via fusion of estimators", 2017.

Manuscripts in preparation

U. Villa, O. Ghattas, "Scalable Optimal Experimental Design with Gaussianized Posteriors"

U. Villa, N. Petra, O. Ghattas, "hIPPYlib: An extensible software framework for large-scale Bayesian Inversion"

U. Villa et al, "Bayesian Calibration of Inadequate Stochastic PDE Models"

U. Villa et al, "A Multilevel Preconditioner for Upscaled Mixed System with Divergence-Free Constraint"

U. Villa et al, "Auxiliary Space H(curl) and H(div) Solvers Based on Upscaled AMGe De Rham Sequences"

Theses

Doctoral Dissertation: *Scalable Efficient Methods for Incompressible Fluid-dynamics in Engineering Problems*. Advisor: A. Veneziani.

Alta Scuola Politecnica diploma: *Environment & energy - Hydrogen: opportunities and utilization*. Advisors: F. Profumo, E. Paolucci, A. Tenconi. External Institutions: Centro Estero Camere di Commercio Piemontesi, STEP Ricerche S.r.l.

Master Dissertation: *Finite Element Analysis of the Brake Pad System and Multibody Modeling of Motor Vehicles in Braking-Phase*. Advisor: A. Veneziani, L. Trainelli, A. Vigliani. External Institutions:"Simulations and Computing" division of Brembo Sps.

Bachelor Dissertation: *Mathematical modeling and numerical simulation of hemodynamics problems in one dimension*. Advisor: A. Veneziani.

Conference presentations

Award winning presentations

A Block-Diagonal Algebraic Multigrid Preconditioner for the Brinkman Problem, 12th Copper Mountain Meeting on Iterative Methods, March 25-30, 2012, Copper Mountain, Colorado, US (student paper competition)

Invited oral presentations in mimisymposia

Maximize the Expected Information Gain in Bayesian Experimental Design Problems: a Fast Optimization Algorithm Based on Laplace Approximation and Randomized Eigensolvers, SIAM Conference on Uncertainty Quantification, April 16-19, 2018, Garden Grove, CA, US

Taylor Approximation for PDE-Constrained Optimal Control Problems Under High-Dimensional Uncertainty: Application to a Turbulence Model, SIAM Conference on Control and its Applications, July 10-12, 2017, Pittsburgh, PA, US

Derivative-informed MCMC for Bayesian Calibration of Stochastic PDE Models, SIAM Annual Meeting, July 10-14, 2017, Pittsburgh, PA, US

Hessian-based Sampling Techniques for Bayesian Inverse Problems with Stochastic PDE Forward Model, Applied Inverse Problems, May 29-Jun 2, 2017, Hangzhou, China

Bayesian Calibration of Inadequate Stochastic PDE Models, SIAM Conference on Computer Science and Engineering, Feb 27-March 3, 2017, Atlanta, Georgia, US

Bayesian Inverse Problems Governed by Stochastic PDE Models, Joint Mathematics Meetings, January 4-7, 2017, Atlanta, Georgia, US

An Analytical Technique for Forward and Inverse Propagation of Uncertainty, SIAM Conference on Uncertainty Quantification, April 5-8, 2016, Lausanne, Switzerland

Highly Scalable Hierarchical Sampling Algorithms for Gaussian Random Fields, SIAM Conference on Computer Science and Engineering, March 14-18, 2015, Salt Lake City, Utah, US

Robust Numerical Methods for the Brinkman Problem, 9th International Conference on Large-Scale Scientific Computations, June 3-7, 2013, Sozopol, Bulgaria (with travel support from symposium organizers)

PALADINS: Scalable Time-adaptive Algebraic Splitting and Preconditioners for the Navier-Stokes Equations, SIAM Conference on Computer Science and Engineering, Feb 25-March 1, 2013, Boston, Massachussets, US

ALADINS: an ALgebraic ADaptive Incompressible Navier-Stokes solver, XVIII International Conference on Computational Methods in Water Resources, June 21-24, 2010, Barcelona, Spain (student volunteer with partial travel support)

Oral presentations

hIPPYlib: An Extensible Software Framework for Large-Scale Deterministic and Linearized Bayesian Inverse, Texas Applied Mathematics and Engineering Symposium, Sept. 21–23, 2017, Austin, Texas, US

AMG Solvers for Upscaled Mixed Finite Element Discretizations, 13th Copper Mountain Conference

on Iterative Methods, Apr 6 - 11, 2014, Copper Mountain, Colorado, US

Multilevel Monte Carlo Simulations with Algebraically Constructed Coarse Spaces, SIAM Conference on Uncertainity Quantification, March 31 - Apr 3, 2014, Savannah, Georgia, US

Block AMG Preconditioners For Mixed Finite Element Discretization of Porous Media Flow Problems, 16th Copper Mountain Conference on Multigrid Methods, March 17-22, 2013, Copper Mountain, Colorado, US

PALADINS: a Scalable Solver for the Navier-Stokes Equations, SIAM Conference on Parallel Processing for Scientific Computing, Feb 15-17, 2012, Savannah, Georgia, US

PALADINS: A Parallel Algebraic Adaptive Navier-Stokes Solver, SIAM Conference on Computer Science and Engineering, Feb 28-March 4, 2011, Reno, Nevada, US

Poster presentations

Integrating Data with Complex Predictive Models under Uncertainty: An Extensible Software Framework for Large-Scale Bayesian Inversion, NSF SI2 PI Meeting, 2017, Arlington, VA, US

Hard problems are fine to coarsen, Computation Postdoc Poster Symposium, March 24^{th}, 2014, Livermore, California, US

Upscaling Techniques for the Brinkman Problem, 2013 DOE Applied Mathematics Program meeting, August 6-8, 2013, Albuquerque, New Mexico, US

Towards Scalable Solvers for the Brinkman Problem, Lawrence Livermore Student Poster Symposium, August 8^{th}, 2012, Livermore, California, US

Robust numerical methods for the Brinkman problem, Lawrence Livermore Student Poster Symposium, August 10^{th}, 2011, Livermore, California, US

ALgebraic time ADaptive splitting schemes for the Incompressible Navier-Stokes equations, 2011 Georgia Scientific Computing Symposium, Feb. 12^{th}, 2011, Atlanta, Georgia, US

Multiphysics Multimodel Domain Decomposition: An Application to Conjugate Heat Transfer, 2010 Georgia Scientific Computing Symposium, Feb. 20^{th}, 2010, Atlanta, Georgia, US

Seminars

Numerical Upscaling and Multilevel Monte Carlo, Stanford University, Stanford, California, 12^{th} November 2014, Algorithms and Architectures Initiative Annual Meeting.

Multilevel Monte Carlo Simulations with Algebraically Constructed Coarse Spaces, Emory University, Atlanta, Georgia, 28^{th} March 2014. Host *A. Veneziani*

Towards Scalable Solvers for the Brinkman Problem, Stanford University, Stanford, California, 4^{th} March 2014. Host *H. Techelepi*

Numerical Upscaling and Algebraic Multigrid for Mixed Finite Element discretizations, Lawrence Berkeley National Laboratory, Berkeley, 11^{th} February 2014. Host *X. S. Li*

Numerical Upscaling and Algebraic Multigrid for Mixed Finite Element discretizations, Tuft University, Boston, Massachusetts, 6^{th} December 2013. Host *J. Adler*

An Optimal Control Approach for Multiphysics Multimodel Domain Decomposition, Stanford University, Stanford, Californa, 7^{th} November 2013. Host *M. Saunders*

Towards Scalable Solvers for the Brinkman Problem, Kennesaw State University, Kennesaw, Georgia, 5^{th} October 2013. Host *Y. Babenko*

Schools, Workshops, and Think-tanks attended

IdeaLab 2015: Inverse Problems and Uncertainty Quantification, July 6-10, 2015, Brown University, Providence, Rhode Island, Us (with travel support from organizers)

Algebraic Multigrid Summit, October 15-18, 2014, Boulder, Colorado, US

Algebraic Multigrid Summit, September 3-8, 2013, Lake City, Colorado, US

Finite Element Exterior Calculus Summer School, June 11-15, 2012, Brown University, Providence, Rhode Island, US (with travel support from organizers)

Adaptive Finite Elements and Domain Decomposition Methods Workshop, June 17-19, 2010, Milan State University, Milan, Italy

Parallel Numerical Simulation School (Athens Program), March 18-23, 2007, Technische Universität München, Munich, Germany

Crash Analysis and Car Dynamics School (Athens Program), November 12-17, 2006, Ecole Nationale

des Ponts et Chaussees, Paris, France

Editorial work

Serving as *editorial board member* of *Numerical Linear Algebra with Applications* since 2018.

Serving as a *reviewer* for the following journals: *SIAM Journal on Scientific Computing* (SIAM), *Numerical Linear Algebra with Applications*, *Numerical Methods in Engineering* (Wiley), *Computational Geosciences*, *Journal of Scientific Computing*, *Numerical Algorithms* (Springer), *Journal of Mathematical Analysis and Applications* (Elsevier)

Minisymposia organizer

T. Bui-Thanh, O. Ghattas, V. Rao, U. Villa, *Efficient Algorithms for Bayesian Inverse Problems Governed by PDE Forward Problems*, SIAM Conference on Computational Science and Engineering, Feb 27-March 3, 2017, Atlanta, GA, US

U. Villa, T. Oliver, N. Petra, O. Ghattas, R. Moser, *Characterizing model inadequacy in Bayesian inference*, SIAM Conference on Uncertainty Quantification, April 16-19, 2018, Garden Grove, CA, US

Service

I interviewed candidates applying for postdoctoral and staff positions at Lawrence Livermore National Laboratory.

Professional affiliations

SIAM member since 2009.

Languages

Italian (primary), English (fluent), Spanish (basic)

Computer Skills

Operating System: Linux, MacOS
Text Editors: Latex, Microsoft Office
Web Editors: Markdown, MkDocs
Programming:
- C++, C, Fortran, Python
- Parallel Computing with MPI and OPENMP.
- Doxygen (source code documentation generator)
- Version control software tools (git, cvs)
- Build automation toos (cmake, automake, autoconf)
- Performance analysis debugging tools (valgrid, gdb, tau)

Scientific Computing libraries:
- Lead developer of hIPPYlib - **I**nverse **P**roblems **Py**thon **lib**rary (`https://hippylib.github.io`)
- Lead developer of Elag, ParElag (element agglomeration multigrid solvers and upscaling tools, `http://github.com/LLNL/parelag`)
- Lead developer of ElagMC, ParElagMC (Multilevel Monte Carlo software based on Elag/ParElag, LLNL confidential)
- Contributor to the finite element library MFEM (`http://mfem.org`)
- Developer of the finite element library LifeV (`www.lifev.org`)
- Author of the sparse linear algebra library t-minres (`https://code.google.com/p/tminres/`)
- Expert user of the FEniCS, Trilinos, Hypre, Suitesparse libraries.

Scientific tools: Matlab, Octave, FreeFem, R (a Statistical Analysis software)

References

Professor Mark Anastasio
Biomedical Engineering
Washington University in St. Louis
St. Louis, MO
e-mail: *anastasio@wustl.edu*

Professor Omar Ghattas
Inst. Computat. Engineering and Sciences
University of Texas at Austin
Austin, TX
e-mail: *omar@ices.utexas.edu*

Dr Panayot Vassilevski
Center for Applied Scientific Computing
Lawrence Livermore National Laboratory
Livermore, CA
e-mail: *vassilevski1@llnl.gov*

Professor Alessandro Veneziani
Dept. of Mathematics and Computer Science
Emory University
Atlanta, GA
e-mail: ale@mathcs.emory.edu