Curriculum Vitae

Akwum Onwunta
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PERSONAL DETAILS

- Date of birth: February 4, 1979.
- Sex: Male.

EDUCATION AND QUALIFICATIONS

- 09/2016: Otto von Guericke University & Max Planck Institute, Magdeburg, Germany.
  Dr. rer. nat. (Ph.D) in Mathematics.
  (Grade = Magna Cum Laude).
- 10/2010: Justus Liebig University, Giessen, Germany.
  Dr. rer. pol. (Ph.D) in Economics.
  (Grade = Magna Cum Laude).
- 05/2007: Université Paris 1, Panthéon-Sorbonne, Paris, France.
  Diplôme d'Université Mathematical Models in Economics and Finance.
  (GPA = 4/4).
- 04/2006: University of Stellenbosch, South Africa.
  Master of Science (M.Sc.) in Physical and Mathematical Analysis.
  (Distinction).
- 07/2003: Michael Okpara University of Agriculture, Umudike, Nigeria.
  Bachelor of Science (B.Sc.) in Mathematics.
  (First Class Honors degree).

EMPLOYMENT HISTORY

- George Mason University, Fairfax, USA.
  August 2020 to date: Postdoctoral Research Associate.
  Major Duties:
  - Conduct independent and collaborative high quality scientific research on numerical algorithms for the solution of
    - PDE-constrained optimization.
    - high-dimensional and nonlinear parameterized PDEs.
  - Teach graduate and / or senior undergraduate courses.
- University of Maryland at College Park, MD, USA.
  July 2018 to June 2020: Postdoctoral Research Associate / Instructor.
  Major Duties:
  - Conduct independent and collaborative high quality scientific research on numerical algorithms based on reduced-order modeling and machine learning techniques for the solution of

    - Bayesian statistical inverse problems;
    - high-dimensional and nonlinear parameterized PDEs.
  - Teach graduate and / or senior undergraduate courses.

- Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany.
  July 2016 - June 2018: Postdoctoral Researcher in Mathematics.
  January 2012 - June 2016: Doctoral Researcher in Mathematics.
  Major Duties:
  - Conducted independent and collaborative high quality scientific research on numerical algorithms for the solution of
    - physical and engineering problems with uncertain inputs;
    - stochastic eigenvalue problems;
    - stochastic optimal control problems;
    - high dimensional and nonlinear dynamical systems.
  - Developed and analyzed efficient tensor-based algorithms to tackle the storage complexity associated with high-dimensional linear systems that would be otherwise intractable on desktop computers.

- Deutsche Bank AG, Frankfurt am Main, Germany.
  July 2007 - October 2010: Quantitative risk analyst & Marie Curie early-stage research fellow for the project: Computational Optimization Methods in Statistics, Econometrics and Finance (COMISEF).
  Major Duties:
  - Developed factor models for efficient quantification of portfolio credit risk at Deutsche Bank.
  - Incorporated and implemented Basel II banking regulations in the Deutsche Bank factor models.
  - Using ratings and equity data from S&P, KMV, etc, I analyzed the dependence structure of obligors in a credit portfolio.
  - Co-organized and participated in financial modeling training workshops and summer schools within the COMISEF project.

PROFESSIONAL MEMBERSHIP

- Member, Society for Industrial and Applied Mathematics (SIAM).

PROFESSIONAL CERTIFICATION

- July - August 2009: Swiss Finance Institute, Lausanne, Switzerland.
  Diploma in Financial Asset Management and Engineering (FAME).
- September 2008: Institute for Market Technology, London, England.
  Certificate in Electronic Trading.
- November 2010 - December 2011: Sant'Anna School of Advanced Studies, Pisa, Italy.
  Advanced Courses in Quantitative Economics and Econometrics.

LANGUAGE AND COMPUTING PROFICIENCY

- English (fluent), German (Advanced), French (Basic).
- Matlab, LaTex, Linux and MS Office, C/C++, SAS (proficient);
  R and Python (advanced).

RESEARCH INTERESTS

Generally speaking, I am interested in the use of computational approach to solve real-world problems with engineering, geophysical, economic, financial, social, or biomedical relevance. In particular, my research interests in scientific computing include:

- Numerical linear algebra (preconditioning techniques, iterative solvers, eigenvalue problems).
- Optimization problems constrained by partial differential equations (PDEs).
- Reduced-order modeling techniques for high-dimensional problems.
- Uncertainty quantification and machine learning.
- Bayesian statistical inverse problems.
- PDEs with uncertain inputs.
- Data assimilation and compression.
- Quantitative credit risk modeling.

SCHOLARSHIPS AND AWARDS

- Research grant (2012 - 2016) for a Ph.D in Applied Mathematics at Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg, Germany by the Max Planck Society.
- Grant for Advanced Courses in Financial Networks and Econometrics in 2011 by Sant'Anna School of Advanced Studies, Pisa, Italy.
- Grant for the SFI professional diploma program: Financial Asset Management and Engineering (FAME), in July 2009 by the Swiss Finance Institute.
- Marie Curie research grant (2007 - 2010) at Deutsche Bank, Frankfurt, Germany, for the EU-funded project Computational Optimization Methods in Statistics, Econometrics and Finance (COMISEF).
- Scholarship for graduate studies in Mathematical Models in Economics and Finance (2006 - 2007) by Université Paris 1, Panthéon-Sorbonne, Paris, France.
- Research grants for a short course and for M.Sc. in Physical and Mathematical Analysis at Stellenbosch University (2004 - 2005) by African Institute for Mathematical Sciences (AIMS), Cape Town, South Africa and African Millennium Science Initiative (AMMSI), respectively.
- The overall best graduating Bachelor's degree student 2001/2002 academic year, Michael Okpara University of Agriculture, Umudike, Umuahia, Nigeria, by Bank PHB, Nigeria.
- Maryville College (USA) Honors Award in March 2001.

PROJECTS AND PUBLICATIONS

1. Papers
   - P. Benner, S. Dolgov, **A. Onwunta**, and M. Stoll, Low-rank solution of an optimal control problem governed by random Navier-Stokes equations. *International Journal for Numerical Methods in Fluids*, pp. 1 - 26, 2020. `https://onlinelibrary.wiley.com/doi/epdf/10.1002/fld.4843`
   - H. C. Elman and **A. Onwunta**, Reduced-order modeling for nonlinear Bayesian statistical inverse problems. Submitted, 2019. `http://arxiv.org/abs/1909.02539`
   - P. Benner, **A. Onwunta**, and M. Stoll, A low-rank inexact Newton-Krylov method for stochastic eigenvalue problems, *Computational Methods in Applied Mathematics*, 19 (1), pp 5 - 22, 2019.
   - P. Benner, **A. Onwunta**, and M. Stoll, On the existence and uniqueness of the solution of a parabolic optimal control problem with uncertain inputs, Submitted, 2018. `https://arxiv.org/abs/1809.10645`

- P. Benner, S. Dolgov, **A. Onwunta**, and M. Stoll, Low-rank solvers for unsteady Stokes-Brinkman optimal control problem with random data, *Computer Methods in Applied Mechanics and Engineering*, 304, pp. 26 - 54, 2016.

- P. Benner, **A. Onwunta**, and M. Stoll, Block-diagonal preconditioning for optimal control problems constrained by PDEs with uncertain inputs, *SIAM Journal on Matrix Analysis and Applications*, 37 (2), pp. 491-518, 2016.

- P. Benner, **A. Onwunta**, and M. Stoll, Low-rank solution of unsteady diffusion equations with stochastic coefficients, *SIAM/ASA Journal on Uncertainty Quantification*, 3 (1), pp. 622 - 649, 2015.

- M. Lyra, **A. Onwunta**, and P. Winker, Threshold Accepting for credit risk assessment and validation, *Journal of Banking Regulation*, 16 (2) pp. 130 - 145, 2015.

- **A. Onwunta**, Contributions to credit portfolio modeling and optimization, *Peter Lang AG - International Academic Publishers*, Frankfurt, Germany, 2011.

- M. Kalkbrener and **A. Onwunta**, Validating structural credit portfolio models, In D. Rösch, and H. Scheule (eds.), *Model Risk: Identification, Measurement and Management*, pp. 233 - 261, Risk Books, London, 2010.

2. Theses
   - **A. Onwunta**, Low-rank iterative solvers for large-scale stochastic Galerkin linear systems, *Ph.D Thesis in Applied Mathematics,* Otto von Guericke University, Magdeburg, Germany, 2016. `https://pure.mpg.de/rest/items/item_2306055/component/file_2400147/content`

   - **A. Onwunta**, On the regularity of refinable functions, *Master's Thesis,* University of Stellenbosch, South Africa, 2006.
     `http://scholar.sun.ac.za/bitstream/handle/10019.1/2881/OnwuntaA.pdf?sequence=1`

SOME CONFERENCES & SPECIAL COURSES ATTENDED

- Training course on Heuristic optimization and its application in portfolio management organized by Department of Econometrics, Université de Genéve in Sils Maria, Switzerland, September 24 - 29, 2007.
- The 34th, 35th and 36th annual international conferences on Macromodels in Warsaw, Gdansk, and Bochnia Poland, December 5 - 8, 2007, December 3 - 6, 2008 and December 2 - 5, 2009 respectively.
- Training course on the applications of agent-based models in computational economics and finance, organized by Centre for Computational Finance and Economic Agents (CCFEA) University of Essex, Colchester, UK, May 21 - 24, 2008.
- Training course on advanced econometrics organized by the Department of Statistics, Probability and Applied Statistics, University La Sapienza, Rome, June 12 - 14, 2008.
- Advanced summer school on 'Financial Instability and Crises' at the Computable and Experimental Laboratory, University of Trento, Italy, June 30 - July 11, 2008.
- Intensive course on the econometrics of microdata by the Faculty of Economics and Business Administration at the University of Giessen, Germany, Nov 17-18, 2008 & Feb 13-14, 2009.
- Young researchers workshop and tutorial in applied finance and financial econometrics at Humboldt Universität zu Berlin, Germany, November 12 - 14, 2009.
- Conference and tutorial on the latest developments in heavy-tailed distributions and their financial applications organized by the European Centre for Advanced Research in Economics and Statistics (ECARES), Université libre de Bruxelles, Belgium, March 25-27, 2010.

- Workshop on portfolio models in quantitative risk management at the Frankfurt School of Finance and Management, April 21-22, 2010.
- Summer school on Econometrics (CIDE) in Bertinoro, Italy, June 27 - July 2, 2011.
- Summer school on computational aspects of uncertainty quantification in Leuven, Belgium, May 27 - 31, 2013.
- Invited minisymposium talk at the 25th biennial conference on numerical analysis, University of Strathclyde, Glasgow, UK, June 25 - 28, 2013.
  Talk:*Low rank solution of unsteady diffusion equation with stochastic coefficients.*
- 85th annual conference of the International Association of Applied Mathematics and Mechanics, Erlangen, Germany, March 10 - 14, 2014.
- Invited minisymposium talk at the SIAM conference on uncertainty quantification, Hyatt Regency Savannah, Georgia, USA, March 31 - April 3, 2014.
  Talk:*Low rank solution of unsteady diffusion equation with stochastic coefficients.*
  `https://meetings.siam.org/sess/dsp_talk.cfm?p=61939`
- Invited minisymposium talk at the SIAM conference on computational science and engineering, The Calvin L. Rampton Salt Palace Convention Center, Salt Lake City, USA, March 14 - 18, 2015.
  Talk: *All-at-once approach to optimal control problems constrained by PDEs with uncertain inputs.*
  `https://meetings.siam.org/sess/dsp_talk.cfm?p=68090`
- Workshop on direct and inverse problems for PDEs with random coefficients, Weierstrass Institute for Applied Analysis and Stochastics (WIAS), Berlin, Germany, November 9 - 13, 2015
  Talk: *Efficient solvers for optimal control problems constrained by PDEs with uncertain inputs.*
  `https://www.wias-berlin.de/WCMS/showabstract.jsp?UQ15-p-0022`
- Invited talk at the 87th annual conference of the International Association of Applied Mathematics and Mechanics (GAMM), Braunsweig, Germany, March 7 - 11, 2016.
  Talk:*Block-diagonal preconditioning for optimal control problems constrained by PDEs with uncertain inputs.*
- Invited minisymposium talk at the SIAM conference on uncertainty quantification, SwissTech Convention Center, EPFL, Lausanne, Switzerland, March 4 - April 8, 2016.
  Talk: *Block-diagonal preconditioning for optimal control problems constrained by PDEs with uncertain inputs.*
  `https://meetings.siam.org/sess/dsp_talk.cfm?p=74448`
- Invited minisymposium talk at the 19th European conference on mathematics for industry (ECMI), Santiago de Compostela, Spain, June 13-17, 2016.
  Talk: *Fast solvers for optimal control problems constrained by PDEs with uncertain inputs.*
  `http://www.usc.es/congresos/ecmi2016/?page_id=2158`
  `http://www.usc.es/congresos/ecmi2016/wp-content/uploads/2016/05/254.pdf`
- Invited minisymposium talk at the 20th conference of the International Linear Algebra Society (ILAS), University of Leuven, Belgium, July 11 - 15, 2016.
  Talk:*Efficient solvers for optimal control problems constrained by PDEs with uncertain inputs*
  `https://ilas2016.cs.kuleuven.be/abstract/?aid=77&akey=43087a1b7d689e76d680754ef0732d36`
- Invited minisymposium talk at the 7th conference on computational methods in applied mathematics (CMAM), University of Jyväskylä, Finland, July 31 - August 6, 2016.
  Talk: *Fast solvers for optimal control problems constrained by PDEs with uncertain inputs.*
  Abstract can be found on page 74 of the Book of abstracts:
  `http://www.mit.jyu.fi/scoma/cmam2016/docs/cmam-7-book-of-abstracts.pdf`
- Invited minisymposium talk at the SIAM conference on computational science and engineering, Hilton Atlanta, Georgia, USA, February 27 - March 3, 2017.
  Talk: *Efficient solvers for Stochastic Galerkin linear systems*
  `https://meetings.siam.org/sess/dsp_talk.cfm?p=82436`

- Invited minisymposium talk at the SIAM Conference on Optimization, Sheraton Vancouver Wall Centre, Vancouver, British Columbia, Canada, May 22 - 25, 2017.
  Talk: *Fast solvers for optimal control problems constrained by PDEs with uncertain inputs.*
  `https://meetings.siam.org/sess/dsp_talk.cfm?p=85220`

- Invited poster presentation at the Surrogate models for UQ in complex systems workshop, the Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, February 5 - 9, 2018.
  Poster: *Fast solvers for optimal control problems constrained by PDEs with uncertain inputs.*
  `http://www.newton.ac.uk/event/unqw02/participants`

- Invited talk at the Department of Mathematics and Statistics, University of Maryland, Baltimore County, Maryland, USA, October 22, 2018.
  Talk: *Fast solvers for PDE-constrained optimization under uncertainty.*
  `https://mathstat.umbc.edu/events/?id=62819`

- Invited talk at the Center for Mathematics and Artificial Intelligence, George Mason University, Fairfax, Virginia, USA, May 29, 2020.
  Talk: *Fast solvers for PDE-constrained optimization under uncertainty.*
  `https://cmai.science.gmu.edu/index.php/events/#colloquium`

TEACHING EXPERIENCE

- Computational Methods in Fall Semester 2018, Spring Semester 2019 & Fall Semester 2019 at the University of Maryland at College Park, MD, USA.
  Duties: Instructor.

- Engineering Mathematics in 2005/2006 at the University of Stellenbosch, Stellenbosch, South Africa.
  Duties: Co-instructor; conducted tutorials; administered tests and exams.

- In 2006, I co-supervised the thesis of an African Institute for Mathematical Sciences' (AIMS) postgraduate student (Isaac Olukunle Abiodun) titled 'Dubuc-Deslauriers Interpolation Wavelets'.

- Abstract Algebra I & II, Differential Equations in 2003: Advanced undergraduate courses at Imo State University's Part-time Centre, Umuahia, Nigeria.
  Duties: Instructor; conducted tutorials; administered tests and exams.

- Numerical Analysis, Differential Equations, Linear Algebra, Real Analysis 2000 – 2003: Undergraduate courses at Michael Okpara University of Agriculture, Umudike, Nigeria.
  Duties: Conducted tutorials.