

Nai-Yuan Chiang

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Education:

- **PhD in Operational Research and Optimization,** **2013**
University of Edinburgh, UK
 - **Supervisor:** Andreas Grothey
- **MSc in Operational Research,** **2008**
University of Edinburgh, UK
 - MSc degree with distinction
- **B.S in Information & Computational Science,** **2007**
Fudan University, China

Research Interests:

- Large-Scale numerical optimization
- Nonlinear and stochastic optimization
- High performance and parallel computing
- Scalable linear algebra and structure-oriented algorithms
- Network systems

Experience:

- **Postdoctoral Appointee, Argonne National Laboratory, Mar/2013-present**
 - Project: “Next-generation optimization under uncertainty and structure-oriented algorithms.”
Supervisor: Victor M. Zavala
 - Main Task: Development of PIPS-NLP, a next-generation solver for parallel nonlinear optimization and development of supporting convergence theory.
 - PI of the project “Next-Generation Optimization” of Argonne Leadership Computing Facility.
- **Teaching Assistant, University of Edinburgh, Sep/2008-Feb/2013**
 - Relevant Courses Taken: Mathematical Programming, Dynamic and Integer Programming and Game Theory, Computing for Operational Research, Optimization Methods in Finance, Simulation, Methodology, Modeling and Consulting Skills,, Stochastic Modeling, Stochastic Optimization, Large-Scale Optimization, Nonlinear Optimization, Numerical Analysis, Operational Research in the Energy Industry, Power Systems Engineering & Economics
 - Tutored different courses in high school, undergraduate and MSc levels.
- **IT Supporter/Intern, Hank Connection Industrial Co., Ltd, Sep/2006-Jan/2007**
 - Solved technical problems in production line and maintained computer system.

Publications:

- N.Chiang and A.Grothey, **Solving Security Constrained Optimal Power Flow Problems by a Structure Exploiting Interior Point Method**, Optimization and Engineering, pp. 1-23, 2014
- N.Chiang, C.Petra and V.M. Zavala, **Structured Nonconvex Optimization of Large-Scale Energy Systems Using PIPS-NLP**, In Proceedings of 18th Power Systems Computation Conference, 2014.
- N.Chiang and V.M. Zavala, **An Inertia-free Filter Line-Search Algorithm for Large-Scale Nonconvex Optimization**, SIAM Journal on Optimization, 2014 (Under Review).

- N.Chiang and V.M. Zavala, **Large-Scale Optimal Control of Interconnected Natural Gas and Electrical Transmission System**, 2015 (*Under Review*).
- Y.Kang, N.Chiang, C.D.Laird and V.M. Zavala, **Nonlinear Programming Strategies on High-Performance Computers**, 2015 (*Under Review*).
- N.Chiang, Fu Lin and V.M. Zavala, **On the Superlinear Convergence of the Dual Newton Decomposition Strategy**, 2015 (*In Preparation*).
- N.Chiang, **Structure-exploiting interior point methods for security constrained optimal power flow problems**, PhD thesis.

Recent Conference Talks:

- 22nd International Symposium on Mathematical Programming July/2015
- 2014 INFORMS Annual Meeting Nov/2014
- 2014 SIAM Annual Meeting July/2014
- SIAM Conference on Optimization May/2014
- SIAM Conference on Uncertainty Quantification Mar/2014
- AIChE 6th Annual Midwest Regional Conference Mar/2014
- 2013 INFORMS Annual Meeting Oct/2013
- Federal Energy Regulatory Commission Technical Conference June/2013
- Midwest Numerical Analysis Day May/2013
- 21st International Symposium on Mathematical Programming Aug/2012
- The 25th European Conference on Operational Researchl July/2012
- The Edinburgh Siam Student Chapter Conference 2011 Feb/2011
- Taiwan Scientific Symposium in Edinburgh Dec/2010

Scientific Community and Professional Societies:

- **Session Organizer** “Nonlinear Optimization in Energy Systems”, 2015 INFORMS Annual Meeting
- **Session Organizer** “Optimization of Energy Systems”, 2014 INFORMS Annual Meeting
- **Session Chair** “Mathematics of Power Grid”, 2014 SIAM Annual Meeting
- *Member of Society for Industrial and Applied Mathematics*
- *Member of The Institute for Operations Research and the Management Sciences*
- *Reviewing Activities:* European Control Conference, Hawaii International Conference on System Sciences, International Journal of Electrical Power and Energy Systems, Computers & Chemical Engineering, SIAM Journal on Optimization, Computational Optimization and Applications.

Extracurricular Activities:

- **Treasurer of the Edinburgh SIAM Student Chapter** 2011-2012
- **Vice president of the Edinburgh Taiwanese Students’ Society** 2008-2011
- **The founder and team leader of Fudan Breezers Baseball Team** 2004-2007

Honors and Awards:

- **Best Speaker Award** Taiwan Scientific Symposium in Edinburgh 2010
- **School of Mathematics Scholarship** University of Edinburgh 2008
- **Annual Best Taiwanese Students Award** Fudan University 2004, 2005

Teaching Experience:

- **MSc Level:**
 - Mathematical Programming •Dynamic and Integer Programming •Computing for Operational Research •Optimization Methods in Finance •Simulation •Methodology, Modelling and Consulting Skills
- **Undergraduates Level:**
 - Mathematics for Chemical Engineers •Applicable Mathematics •Mathematics for Informatics •Differential Equation Modelling and Solution •Mathematics for ElecMech Eng •Mathematical Methods •Linear Programming and Numerical Analysis
- **High School Level:**
 - Lothian Equal Access Programme for Schools (LEAPS) Summer School (introducing students to university maths.
 - Higher Maths Revision for students from high schools in Edinburgh.

Software & Implementations:

- **PIPS-NLP** (Parallel Interior Point Solver for NLP)
C++ implementation with MPI and OpenMP. A parallel interior-point optimization solver for large-scale nonlinear programming problems. It can exploit problem embedded structures such as network (graph partitioning), reduced space (PDAEs/DAEs), and robust and stochastic structures. It provides an easy-access computational framework that enables benchmarking of customized algorithms on high-performance computers and it provides interfaces to different modeling languages, e.g. AMPL, Pyomo and JuMP. It implements inertia-free linear algebra strategies and solver has been used to successfully solve large-scale stochastic gas networks with PDAE constraints and security-constrained power flow problems on Fusion and IBM BG/Q clusters.
- **OOPS** (Object-Oriented Parallel Solver)
C/C++ implementation with MPI. The first parallel interior-point optimization solver that can exploit the special structures of optimization problems. It is implemented using object-oriented techniques, which focusing on exploiting any special structure arising in the Jacobian and Hessian matrices. The nonlinear extension was implemented in 2012.
- **Miscellaneous**
 - A modified IPOPT implementation that supports inertia-free strategies and structured BFGS updates for problems with hidden constraints.
 - A dual newton decomposition framework for structured network problems in Matlab.
 - Matlab-Ampl interface to construct structured optimization problems in Ampl and enable prototyping of new algorithms in Matlab.

Qualifications & Skills:

- **Language:** English/Fluent, Mandarin/Native, Japanese/Intermediate(JLPT Level 3)
- **Computing skills:**
 - Programming: Fortran, Java, Julia, Python, C, C++, MPI, OpenMP.
 - Mathematics/Simulation: Matlab, XpressMP, Ampl, Pyomo, Spss, Simul8