Alp Dener

+1 (630) 252 0062 • adener@anl.gov • alp.dener.me

Research Interests

Optimization: PDE-constrained Problems, Gradient-based Algorithms, Sensitivity Analysis, MDO Architectures
Machine Learning: Physics Informed Neural Networks, Constrained Training Methods, Supervised Learning
Scientific Computing: High Performance Computing for Optimization, Reusable Scientific Software

Education

Rensselaer Polytechnic Institute December 2017
Aeronautical Engineering, Ph.D.

University of Maryland, Baltimore County May 2012
Mechanical Engineering, B.S.

Work Experience

Postdoctoral Appointee – Argonne National Laboratory Feb 2018–Present
Mathematics and Computer Science Division Supervisor: Todd S. Munson
- Principal developer on Toolkit for Advanced Optimization (TAO) and contributor to PETSc
- Research large-scale optimization algorithms with efficient treatment of nonlinear constraints
- Promote TAO, expand its user base, and provide software support for external researchers

Graduate Research Assistant – Rensselaer Polytechnic Institute Feb 2013–Dec 2017
Optimal Design Lab Supervisor: Jason E. Hicken
- Investigate PDE-constrained multi-disciplinary design optimization problems
- Research gradient-based, reduced-space, matrix-free optimization algorithms
- Develop a parallel-agnostic optimization library tailored for large-scale engineering systems

Undergraduate Research Assistant – University of Maryland, Baltimore County Oct 2010–May 2011
Joint Center for Earth Systems Technology Supervisor: Gergely Dolgos
- Construction of an optical aerosol measurement instrument
- Design and manufacture of high-precision optical component mounts
- Propose instrument mounting solutions for the NASA GSFC science fleet aircraft

Honors & Awards

- AIAA Student Paper Competition - 1st Place 2018
  - Category: Multidisciplinary Analysis and Optimization

Publications

Journal Articles

Dener, Alp, Marco Andres Miller, et al. (2020). "Training neural networks under physical constraints using a stochastic augmented Lagrangian approach (submitted)". In: *Journal of Computational Physics*.

Miller, Marco Andres et al. (2020). "Encoder-decoder neural network for solving the nonlinear Fokker-Planck-Landau collision operator in XGC (accepted)". In: *Journal of Plasma Physics*.

Dener, Alp and Jason E. Hicken (2017). "Matrix-free Algorithm for the Optimization of Multidisciplinary Systems". In: *Structural and Multidisciplinary Optimization, Springer*. DOI: 10.1007/s00158-017-1734-0.

Hicken, Jason E. and Alp Dener (2015). "A Flexible Iterative Solver for Nonconvex, Equality-constrained Quadratic Subproblems". In: *Journal on Scientific Computing, SIAM*. DOI: 10.1137/140994496.

Conference Proceedings

Dener, Alp, Adam Denchfield, and Todd S. Munson (June 2019). "Preconditioning nonlinear conjugate gradient with diagonalized quasi-Newton". In: *Proceedings for the Platform for Advanced Scientific Computing Conference*. Zurich, Switzerland. DOI: 10.1145/3324989.3325712.

Dener, Alp and Todd S. Munson (June 2019). "Accelerating Limited-Memory Quasi-Newton Convergence for Large-Scale Optimization". In: *International Conference on Computational Science*. Faro, Portugal. DOI: 10.1007/978-3-030-22744-9_39.

Dener, Alp, Jason E. Hicken, et al. (June 2018). "Enabling Modular Aerostructural Optimization: Individual Discipline Feasible without the Jacobians". In: *2018 Multidisciplinary Analysis and Optimization Conference, AIAA AVIATION Forum*. Atlanta, GA, USA. DOI: 10.2514/6.2018-3570.

Dener, Alp, Pengfei Meng, et al. (Jan. 2016). "Kona: A Parallel Optimization Library for Engineering-Design Problems". In: *57th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, AIAA SciTech Forum*. San Diego, CA, USA. DOI: 10.2514/6.2016-1422.

Dener, Alp, Gaetan K. W. Kenway, et al. (Jan. 2015). "Comparison of Inexact- and Quasi-Newton Algorithms for Aerodynamic Shape Optimization". In: *53rd AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*. Kissimmee, FL, USA. DOI: 10.2514/6.2015-1945.

Dener, Alp and Jason E. Hicken (Jan. 2014). "Revisiting Individual Discipline Feasible with matrix-free Inexact-Newton-Krylov". In: *10th AIAA Multidisciplinary Design Optimization Conference, AIAA SciTech Forum*. National Harbor, MD, USA. DOI: 10.2514/6.2014-0110.

Preprints / Working Papers

Hicken, Jason E, Pengfei Meng, and Alp Dener (2017). "Error-tolerant multisecant method for nonlinearly constrained optimization". In: *arXiv preprint arXiv:1709.06985*.

Doctoral Thesis

Dener, Alp (Dec. 2017). "A Modular Matrix-free Approach to Multidisciplinary Design Optimization". PhD thesis. Rensselaer Polytechnic Institute.