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Ahmed Bayoumy, PhD

Education

2015–2019 **PhD**, *McGill University*, Montreal.
Mechanical Engineering Department, Systems Optimization Lab

Thesis A Relative Adequacy Framework for Multi-model Management in Single- and Multi-disciplinary Design Optimization

2010–2014 **MSc**, *Cairo University*, Egypt.
Mechanical Design and Production Engineering

Thesis Modeling and Simulation of Large-Size Wind Turbine Blades Geometry Using Absolute Nodal Coordinate Formulation with Enhancement of its Performance

2008 **BEng**, *Benha University*, Egypt.
Mechanical Engineering Department

Research Projects

2018–2020 **NSERC CRD Research Assistant**, *Siemens*, Montreal, Canada.

- Developed a python package (PyNoHiMDO) for running multidisciplinary design optimization (MDO) problems using a penalty-based distributed interdisciplinary feasible (IDF) formulation known as non-hierarchical analytical target cascading (NHATC.)
- Utilized PyNoHiMDO to automate and accelerate the convergence of the feedback coupling between the gas turbine performance analysis and secondary air system analysis (engine bleeds flow analysis.)
- Set up the MDO workflow of the intermediate pressure turbine (IPT) blade of the aero-derivative gas turbine engines (AGT) using two MDO architectures: monolithic multidisciplinary feasible (MDF) and IDF approaches.
- Integrated the developed PyNoHiMDO into ACES, AutoOpti and HEEDS.

Employment History

2020–present **Software Engineer**, *Siemens Digital Industries Software*, Montreal, Canada.

- Contribute to the development of HEEDS MDO framework and the enhancement of SHERPA's algorithmic properties.
- Implement state-of-the-art technologies and research findings in MDO, simulation-based optimization and derivative-free optimization.
- Propose and develop approaches, strategies and solutions for pressing technical challenges associated with MDO such as:
  - Hierarchical and non-hierarchical MDO architectures
  - Nonhierarchical coordination for distributed MDO
  - Knowledge-based optimization
  - Variables and responses dependency relationships
  - Linking evolutionary global optimizers with derivative-free optimizers to ensure a balance of a global search heuristic with a stronger local convergence analysis
  - Restart updates
  - Machine learning tools
  - Reduced order models (ROMs) and data-driven dynamics
  - Post-processing
  - Benchmarking
- Work in Agile environment; utilize Agile scrum practices.

2012–2015 **Group Leader**, *Power Generation Engineering and Services Company (PGESCo), BECHTEL corporation*, Cairo, Egypt.

- Developed a finite element analysis and design application software package; Pipe Supports Design and Analysis (PSD), based on linear structural analysis and international design codes and standards.
- Contributed to the coordination and integration of combustion turbine and steam turbine packages for combined cycle plants and boiler-STG packages for thermal power plants, co-generation plants, and gas- and oil-fired plants.
- Contributed to developing design guides for conducting structural, flow, and fluid-structure interaction analyses for critical systems at off-design conditions and different modes of plant operation, e.g., start-up, trip, and shut-down.

2010–2012 **Mechanical Design Engineer**, *EIE Group Company*, Cairo, Egypt.

- Instructor for mechanical modeling and dynamic simulation using UNIGRAPHICS NX, AUTODESK INVENTOR, and ANSYS.
- Reverse engineering; modeling using FARO laser scanning arm and GEOMAGIC.
- Specialist of piping design and stress analysis.

Leadership and Supervision

2014–2015 **Deputy Engineering Group Supervisor**, *PGESCo, BECHTEL corporation*, Cairo, Egypt, Hydraulic and Transient Analysis Group.

2013–2014 **Plant Design Engineering Group Leader**, *PGESCo, BECHTEL corporation*, Cairo, Egypt, Stress Analysis Central Group.

2012–2013 **Mechanical Engineering Group Leader**, *PGESCo, BECHTEL corporation*, Cairo, Egypt, Design Review Central Group.

Awards

2015–2018 **McGill Engineering Doctoral Awards (MEDA)**, *McGill University*, Montreal, Canada. It is awarded in the amount of $37,000 CAD each year for three academic years, a total value of $111,000 CAD.

Articles in Archival Journals

[1] A. Bayoumy and M. Kokkolaras. Multi-model Management for Time-dependent Multidisciplinary Design Optimization Problems. *Structural and Multidisciplinary Optimization*, 61(5):1821–1841, 2020.

[2] A. Bayoumy and M. Kokkolaras. A Relative Adequacy Framework for Multimodel Management in Multidisciplinary Design Optimization. *Structural and Multidisciplinary Optimization*, 62(4):1701–1720, 2020.

[3] A. Bayoumy and M. Kokkolaras. A Relative Adequacy Framework for Multi-Model Management in Design Optimization. *Journal of Mechanical Design*, 142(2), 2019.

[4] A. Bayoumy, A. Nada, and S. Megahed. Methods of Modeling Slope Discontinuities in Large Size Wind Turbine Blades using Absolute Nodal Coordinate Formulation. *Proceedings of the Institution of Mechanical Engineers, Part K: Journal of Multi-body Dynamics*, 228(3):314–329, 2014.

[5] A. Bayoumy, A. Nada, and S. Megahed. A Continuum Based Three-Dimensional Modeling of Wind Turbine Blades. *Journal of Computational and Nonlinear Dynamics*, 8(3), 2012.

Articles in Conference Proceedings

[1] T. Peoc'h, A. Bayoumy, M. Staniszewski, H. Moustapha, M. Kokkolaras, and F. Garnier. Integration of Secondary Air System for Multidisciplinary Design Optimization of Gas Turbines. In *AERO2019*, Laval, Quebec, Canada, 2019. Canadian Aeronautics and Space Institute.

[2] A. Bayoumy and M. Kokkolaras. A Relative Adequacy Framework for Multimodel Management in Multidisciplinary Design Optimization. In *Multidisciplinary Analysis and Optimization Conference*, Atlanta, Georgia, USA, 2018. AIAA.

[3] A. Bayoumy and M. Kokkolaras. A Reference Error Formulation for Multi-fidelity Design Optimization. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, volume 58134, Cleveland, Ohio, USA, 2017. ASME.

[4] A. Papadopoulos, M. Ismail, and A. Bayoumy. Dynamic Amplification Factor for Rigid and Flexible Piping System due to Steam Hammer Transient Load. In *ASME International Mechanical Engineering Congress and Exposition*, volume 57397, Houston, Texas, USA, 2015. ASME.

[5] A. Bayoumy and A. Papadopoulos. Time History Steam Hammer Analysis for Critical Hot Lines in Thermal Power Plants. In *International Mechanical Engineering Congress and Exposition*, page 11, Montreal, Quebec, Canada, 2014. ASME.

[6] A. Bayoumy, A. Nada, and S. Megahed. Use of Forward Dynamics Model for Designing Large-size Wind Turbine Blades. In *ASME International Mechanical Engineering Congress and Exposition*, volume 56253, San Diego, California, USA, 2013. ASME.

[7] A. Bayoumy, A. Nada, and S. Megahed. Modeling Slope Discontinuity of Large Size Wind-turbine Blade Using Absolute Nodal Coordinate Formulation. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, volume 45059, pages 105–114, Chicago, Illinois, USA, 2012. ASME.

Workshop talks

2022 **2nd AIAA Workshop for Multifidelity Modeling in Support of Design and Uncertainty Quantification**, *Workshop Link*.

Reviewer

2020, present **Structural and Multidisciplinary Optimization journal, Springer**.

2020, present **ASME Journal of Mechanical Design**.

Teaching Assistant

2016, 2019 **MECH 559: Engineering Systems Optimization**, *McGill University, Montreal, Canada.*

2017, 2019 **MECH 501, 502: Analysis, Synthesis, and Optimization of Engineering Systems**, *McGill University, Montreal, Canada.*

2017-2019 **MECH 290: Design Graphics for Mechanical Engineering using SolidWorks**, *McGill University*, Montreal, Canada.

2016, 2018 **MECH 292: Conceptual Design**, *McGill University*, Montreal, Canada.

2016 **MECH 539: Computational Aerodynamics**, *McGill University*, Montreal, Canada.

2018–2019 **MECH 400: Engineering Professional Practice**, *McGill University*, Montreal, Canada.

Open source code library

I participated in the development of academic and industrial software packages that provide multidisciplinary design optimization and blackbox optimization algorithms. I authored open-source codes that have been used in various research projects. Including, but not limited to, four python packages that can work together to manage the use of multiple models during design optimization. Each developed package can work per se to provide its function in other design/optimization contexts. The codes are maintained on the following GitHub repositories:

- Orthogonal Mesh Adaptive Direct Search (OMADS) [Link] [OMADS webpage]
- Surrogate Models Library (SML) [Link]
- Relative Adequacy Framework (RAF) [Link]
- Distributed Multidisciplinary Design Optimization (DMDO) [Link] [Jupyter Notebook]
- Nonlinear Optimization Benchmarking Library (NOBM) [Link]

Languages

English	Fluent
French	Basic
Arabic	Native