Ahmed Bayoumy, PhD

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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, 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.

Languages

English	Fluent
Arabic	Native