**RITESH KHIRE**

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**EDUCATION:**

* Ph.D. (Mechanical Engineering), Rensselaer Polytechnic Institute, Troy, NY 2006
* M.S. (Mechanical Engineering) Rochester Institute of Technology, Rochester, NY 2003
* B.E. (Mechanical Engineering) University of Bombay, India 1999

**CAREER HIGHLIGHTS:**

* Extensive background in **data analytics**, **machine learning**, and **optimization techniques**.
* Over 8 years’ experience in delivering technical research: results / methods with business impact
* Leadership: Task-lead and Principle Investigator on multiple projects since 2011. Have led teams of 5 researchers.
* Invited speaker at international conferences and reviewer for NSF proposals.
* Published 2 Book chapters, 7 Journal papers, 2 granted patents, and over 25 peer reviewed conference papers
* Continuing education: Pursuing MS in Data Science from WPI - part time

**TECHNOLOGY:**

**Matlab, R, AMPL** (CPLEX, Gurobi, ipopt), iSight, ANSYS (Static FE and topology optimization)

Familiarity with: **Genie-Smile, SAS**, Dymola, Modelica, TEAMS, openMDAO, Python

Deployed **data analytics**, **machine learning**, and reduced order methods for various applications, e.g.

* Machine learning approaches developed for Condition Based Maintenance for aircraft engines
  + Fault isolation method based on **event grouping** and **Bayesian inference** algorithms
  + Mission identification: **classification** problem with **multivariate time series** (non & uniform sampling)
  + **Feature selection** for building prognostic model -- predict maintenance based on usage
  + **Unsupervised learning** and **regression models** to identify key variables affecting damage
* Data analysis to identify flight conditions (internal and external) aggravating commercial airline faults
* Fault propagation assessment using probabilistic **graphical models** (Bayesian Network)
* Sampling based **reduced order models**: 2nd order polynomial, Radial Basis Functions, krigging, etc

Developed **optimization methods** for industrial applications e.g.

* Product family optimization to increase commonality in air-conditioning systems - **Genetic Algorithm (NSGA-II)**
* Architecture selection for energy efficient system designs (e.g. microgrids) - Mixed integer linear programing
* Multi-objective optimization based design space exploration - energy efficiency vs. cost for HVAC systems
* Extensive experience in linear, non-linear and mixed-integer programming

**PROFESSIONAL EXPERIENCE:**

*Staff Research Engineer,*United Technologies Research Center, East Hartford, CT 06108 Apr’11– To Date

Condition Based Maintenance for F-135 aircraft engine (Ongoing since Dec-2013)

* Data driven activity, which requires combination of **data-mining, machine learning,** and **predictive models**
* Developed Fault-Isolation method based on flight data
  + Isolation algorithm uses (1) one vs multiple fault separation logic and (2) **Bayesian inference**
* Testability analysis: Predicting **fault isolation** capability of engine health monitoring system
  + Bayesian analysis with Failure Modes and Effects Analysis and D-matrix (probabilistic relation between faults and sensors)
* Developing life usage models for predicting engine maintenance: **Feature selection** and **time series analysis**
  + **Feature selection** for building prognostic model -- predict maintenance based on usage
  + **Unsupervised learning** and **regression models** to identify key variables affecting incremental damage
* Developed mission identification process based on fight data - **multiclass classification** with multivariate time series
* Project planning and coordinating team of 2 researchers/engineers and 2 external contractors

Data analytics for identifying causes for fault on modern airliner (Boeing 787)

* Part of two-person team to identify potential causes for a recurring air-management system fault
* Using statistical techniques (simple **correlation/regression** and **Bayesian Networks**), identified flight conditions (internal and external) that aggravate faults

Energy Efficient Building Hub (DOE Funded Initiative at Philadelphia Navy Yard)

* Developed **probabilistic graphical models** to predict the effect of fault propagation based on building data
* Principal Investigator and Sub-task lead for Whole Building Operations Platform ($0.5M - 2013)
* Leadership activities: Supervise development of middleware and energy Human Machine Interface

Optimization Based Architecting Microgrids in Ultra Low Energy Communities

* Principle Investigator on a $2.4M research proposal funded by US Army Corps of Engineers. Coordinated 3-5 researchers.
* Development of optimization methods for **generating architectures** for energy efficient micro-grids
* Coordinating with universities (external partners) on **Model transformation** and **Interactive Visualization**

Next Generation of Low Energy Lock Cores ($1.4M program between 2012 -13)

* Principal Investigator for mechanical systems: **Supervise** and coordinate activities of **5 researchers**
* Project successfully **completed research** phase and is in **product development** phase at Business unit
* **Develop** and **risk reduce** low energy miniature locking mechanism and actuator - TRL6

Elevator assisted evacuation of mega-tall buildings during emergencies

* Demonstrated the benefit of adapting evacuation strategy to fire/smoke propagation -- risk reduced by 50%
  + **Discrete time dynamic network flow model** solved with **linear programing** (LP) solver
* Filled four patents on the use of elevator and other available building equipments during evacuations

*Sr. Research Engineer*, United Technologies Research Center, East Hartford, CT 06108 Apr’07– Mar’11

**Product family optimization**: optimizing energy efficiency and increase commonality

* **Developed optimization scheme** to design evaporators that (1) improve energy efficiency and (2) are common across different products **(NSGA-II)**
* **Developed** human-in-loop design -- **visualization based decision making tool** for selecting common components
* Design recommendations adapted by Carrier air-conditioning in 2010 products and methods adapted as standard work

**Optimization based method** for identifying temperature sensor location for gas heat furnace

* Identified robust temperature sensor location: NLP **optimization** + **Radial Basis Function** to approximate CFD **data**

Development of **Modular Architecture** Design Method

* Developed modular architecture for container refrigeration units: Resulted in increase in common modules (~ 66%)
* Tools & methods currently being used by business unit (Carrier-Methods team) for future product development

Lighter structures using topology optimization

* Developed concepts for 20% lighter frames for container refrigeration and elevator cab using topology optimization
* Demonstrated fixed cost savings compared to baseline using simplified economic models

Next Generation-Energy Efficient Locks

* Design, modeling, and prototyping of low-energy indirect-drive clutch mechanism for commercial door lock
* Performed FMEA (Failure Mode Effect Analysis) to identify failure modes and methods to reduce them

**RESEARCH EXPERIENCE:**

*Post-doctoral Researcher*, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY12180 Oct’06– Mar’07

Supervisor: Prof. Prabhat Hajela

* Reliability-based design: developed design methods for multi-scale (component level and product level) systems.
* Analyze uncertainty propagation through various length scales of composite structures

*Research Assistant*, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY 12180 Aug’03– Sep’06

Advisor: Prof. Achille Messac

* Developed Selection Integrated Optimization (SIO) method for Adaptive systems, and Product Family Optimization
* Development of a new air-conditioner technology: Active Building Envelopes (ABE) Systems.
* Uncertainty based design of Active Building Envelope (ABE) Systems (accounting for weather uncertainties).
* Implemented response surface based approximations in the optimization of ten-bar-truss.
* Economic viability assessment of ABE systems using life cycle cost to identify critical areas of future research.

*Research Assistant*, Rochester Institute of Technology, 1 Lomb Memorial Dr., Rochester, NY 14623 Aug’01–Jul’03

Advisor: Prof. Wayne Walter

* Performed design and optimization of thermally actuated MEMS mechanism using ANSYS.
* Extensively investigated (1) the placement of heaters and (2) the role of natural cooling on the performance.
* Developed and prototyped an improved cooling mechanism -- MEMS Fabrication experience

**OTHER EXPERIENCE:**

*Design Engineer*, Thakur Technologies Ltd., Bombay (India) May’01–Jul’01

* Involved in the design of Precision drilling machine.

*Lecturer*, University of Bombay at Vidyavardhini’s college of Engg, (India) Jan’01–May’01

* Taught Engineering Economics to Mechanical Engineering and Information Technology (IT) students.

*Junior Engineer*, Mahindra & Mahindra Ltd. (Tractor Division), Bombay (India) Jul’99–Sep’00

* Coordinated 15 QA inspectors for performing inspection of various items e.g. casting, electrical, sheet metals etc.
* Successful Implementation of ISO-9001 and QS-9000, in the department.
* Actively involved in QA (Quality Assurance) procedures such as MSA, PPAP, and FMEA.

**continued education**

* Completed online Machine Learning course from Stanford (June 2014)
* MS in Data Science from WPI started in Jan 2015. Funded via UTC-ESP.

**Awards and Achievements:**

* Recipient of Outstanding Achievement Awards from UTRC -- 2009 and 2014
  + OAA - the highest UTRC award, which recognizes exceptional performance and business impact
* Invited speaker at experts panels on
  + “Design Integration Software: The User Perspective” at 2008 ASME IDETC/CIE Conference
  + “Design of Large Scale Systems – MDO Past, Present, Future” 2010 at AIAA MAO Conference
* Invited reviewer for NSF proposals : Green Building Design (2010) and MDO methods (2011)
* PI on Research proposal to Army Corps of Engineers on -- won $2.4M (2010-2011)

**PREFESSIONAL ACTIVITIES:**

* Associate Member of AIAA Multi-disciplinary Design Optimization Technical Committee (MDO-TC).
* Senior Member: AIAA (American Institute of Aeronautics and Astronautics)
* Conference organizing committee -- ASME International Design Engineering Technical Conferences (2007- 15)
  + Special Session: Modeling, Design and Analysis of Sustainable Energy Systems
  + Special Session: Product Family and Product Platform Design
* Presented the outcome of the research at various international conferences.

**Peer Review Assignments**

* Invited reviewer for NSF proposals
* Journal Reviewer: AIAA Journal, Structural Multi-disciplinary Optimization, Optimization and Engineering, Engineering Optimization journal, Journal of Heat Transfer, and Journal of Mechanical Design

**Invited Session Chair Assignments**

* AIAA MAO Conference: 2010, 2012, 2014
* ASME IDETC/CIE Conference : 2008-2013
* AIAA MDO specialist conference: 2007 - 2015

**Publications:**

**Book Chapter**

* Khire, R. A., Wang, J., Bailey, T., Lin, Y. and Simpson, T., Product Family Commonality Selection Using Optimization and Interactive Visualization, Springer, NY, 2014, pp 449-471
* Messac, A., Chowdhury, S., and Khire, R. A., One-Step Continuous Product Platform Planning: Methods and Applications, Product Platform and Product Family Design, Springer, NY, 2014, pp 295-321

**Journal Publications**

* Oggianu. S., Khire, R., Desai, N., Zeidner, L., Raghunathan, A., Huang, R., “Methodology for Architecting Energy Systems in Ultra Low Energy Communities”, International Journal of Distributed Energy Resources, Vol 9, No 3, 2013.
* Chowdhury, S., Messsac, A., and Khire, R., Investigating the Commonality Attributes for Scaling Product Families using Comprehensive Product Platform Planning (CP3), Structural and Multidisciplinary Optimization, December 2013, Volume 48, Issue 6, pp 1089-1107
* Chowdhury, S., Messac, A., and Khire, R. A., “Comprehensive Product Platform Planning (CP3) Framework,” Journal of Mechanical Design (special Issue on Designing Complex Engineered Systems). Vol. 133, Issue 10, No. 101004, October, 2011.
* Bahei-El-Din Y., Khire R. A., and Hajela P., “Multiscale Transformation Field Analysis of Progressive Damage in Fibrous Laminates”, International Journal for Multiscale Computational Engineering, Year 2010, Volume 8 / Issue 1, Pages 69-80
* Khire, R. A., and Messac, A., “Selection-Integrated Optimization (SIO) Methodology for Optimal Design of Adaptive Systems,” Journal of Mechanical Design, 130(10): 101401
* Khire, R. A., Messac, A., and Van Dessel, S., “Design of a Thermoelectric Heat Pump Unit for Active Building Envelope System,” Int. Journal of Heat and Mass Transfer, Vol. 48, 2005, pp 4028-4040.
* Khire, R. A., Van Dessel, S., Messac, A., and Mullur, A. A., "Study of a Honeycomb-Type Rigidified Inflatable Structure for Housing," ASCE Journal of Structural Engineering, Vol. 132 (10), Oct. 2006, pp 1664 - 1672.

**Patent Application**

* Calabrese J.; Jonsson U.; Khire R. A.; Lakamraju V.; Milton-Benoit J.; Paholsky R.; Wang J.; Yamanis J., “Battery Fire Prevention Device” Filled in Jun 2008 (File # : PA-0009650-WO U71.500-0043).
* Binek, L., Khire. R., Kuczek, A., Jonsson, U., Lakamraju, V., “Lock Core With Recessed Pop Out Knob”, Filled in May 2013 (File # : PA-0023582-US)

**Conference Publications**

* Quimby, P., Khire, R., Leonardi, L., Sarkar, S., “A Novel Human Machine Interface for Advanced Building Controls and Diagnostics”, 3rd International High Performance Buildings Conference at Purdue, 2014.
* Khire, R., Trcka, M., “Model Based Failure Mode Effect Analysis on Whole Building Energy Performance”, 13th International Conference of the International Building Performance Simulation Association, Chambéry France, 25-28 August 2013
* Chowdhury, S., Messac, A. and Khire, R., “Comprehensive Product Platform Planning (CP3) Using Mixed-Discrete Particle Swarm Optimization and A New Commonality Index,” ASME 2012 International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), Paper no. DETC2012-70954, Chicago, IL, August 12-15, 2012.
* Chowdhury, S., Messac, A., and Khire, R., Comprehensive Product Platform Planning (CP3) Using Mixed-Discrete Particle Swarm Optimization and a New Commonality Index, ASME 2012 International Design Engineering Technical Conferences (IDETC), No. DETC2012-70954. Chicago, IL, August 12-15, 2011.
* Chowdhury, S., Messac, A., and Khire, R., Developing a Non-gradient Based Mixed-Discrete Optimization Approach for Comprehensive Product Platform Planning (CP3), 13th AIAA/ISSMO Multidisciplinary Analysis Optimization Conference, Fort Worth, Texas, September 13-15, 2010.
* Khire, R. A.; Becz, S.; Reeve, H.; Zeidner, L., “Assessing performance uncertainty in complex hybrid systems”, 2010 AIAA Aviation Technology, Integration, and Operations (ATIO), Fort Worth, TX,
* Zeidner, L., Becz, S.; Reeve, H.; Khire, R. A.;, “Design Issues for a Bottom-Up Complexity Metric Applied to Hierarchical Systems”, 2010 AIAA Aviation Technology, Integration, and Operations (ATIO), Fort Worth, TX,
* Becz, S.; Allessandro, P.; Zeidner, L., Khire, R. A.; Reeve, H.;, “Design System for Managing Complexity in Aerospace Systems”, 2010 AIAA Aviation Technology, Integration, and Operations (ATIO), Fort Worth, TX,
* Chowdhury, S.; Messac, A.; and Khire, R. A.; “Comprehensive Product Platform Planning (CP3) Framework: Presenting a Generalized Product Family Model”, 51st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 12 - 15 April 2010, Orlando, Florida.
* Khire R. A, Wang J., Bailey T., Lin Y., Simpson T., “Product Family Commonality Selection Through Interactive Visualization”, 2008 ASME IDETC & CIE Design Automation Conference, New York City, NY, Aug 2008
* Lin Y., Dong L., Bailey T., Khire R. A, Wang J., Simpson T., “Model Validation and Error Modeling to Support Sequential Sampling”, 2008 ASME IDETC & CIE Design Automation Conference, New York City, NY, Aug 2008
* A. Messac, R-S. Birthwright, S. Vandessel, R. Khire, and S. Rangavajhala, “Optimization based design of Active Thermal Insulator: An emerging energy efficient window”, 7th World Congress on Structural and Multidisciplinary Optimization, Seoul, May 2007
* Khire R. A., and Messac A., “Pareto Frontier Exploration of Adaptive Systems Using the Selection- Integrated Optimization (SIO) Methodology”, 3rd AIAA Multidisciplinary Design Optimization Specialist Conference, 23 - 27 April, 2007, Honolulu, Hawaii
* Rangavajhala S, Khire R. A., and Messac A., “Decision Making in Product Family Optimization Under Uncertainty”, 3rd AIAA Multidisciplinary Design Optimization Specialist Conference, 23 - 27 April, 2007, Honolulu, Hawaii
* Khire R. A., Hajela P., and Bahei-El-Din Y., “Handling Uncertainty Propagation in Laminated Composites Through Multiscale Modeling of Progressive Failure”, 3rd AIAA Multidisciplinary Design Optimization Specialist Conference, 23 - 27 April, 2007, Honolulu, Hawaii
* Khire, R. A., and Messac, A., “Selection-Integrated Optimization (SIO) Methodology for Optimal Design of Adaptive Systems,” ASME IDETC & CIE Design Automation Conference, Philadelphia, PA, Sept 2006.
* Khire R. A., Messac A., and Simpson T. “Optimal Design of Product Families Using Selection-Integrated Optimization (SIO) Methodology” 11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Portsmouth, VA Sep 2006
* Rangavajhala S, Khire R. A., and Messac A., “Impact of Weather Uncertainties on Active Building Envelopes (ABE” 11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Portsmouth, VA Sep 2006
* Khire, R. A., and Messac, A., “Selection-Integrated Optimization (SIO) Methodology for Adaptive Systems Optimization,” 2nd AIAA Multidisciplinary Design Optimization Specialist Conference, Newport, RI, May 1-4, 2006.
* Rivas, F, Khire, R. A., Messac, A., and Van Dessel, S. “Life Cycle Cost Based Economic Assessment of Active Building Envelope (ABE) Systems,” 2nd AIAA Multidisciplinary Design Optimization Specialist Conference, Newport, RI, May 1-4, 2006.
* Khire, R. A., and Messac, A., “Design of Thermoelectric Heat Pump for Active Building Envelope Systems,” 2005 ASME International Mechanical Engineering Congress and Exposition, Orlando, FL, Nov. 2005.
* Khire, R. A., Mullur, A. A., and Messac, A., "An Optimization Based Methodology to Design Flexible Systems Subjected to Changing Operating Conditions," ASME IDETC & CIE Design Automation Conference, Long Beach, CA, Sept 2005. 2006
* Rivas, F., Khire, R. A., Messac, A., and Van Dessel, S., “Economic Viability Assessment of Active Building Envelope Systems,” 1st AIAA Multidisciplinary Design Optimization Specialist Conference, Austin, TX, April 2005.
* Khire, R. A., Van Dessel, S., Messac, A., and Mullur, A. A., "Study of a Honeycomb-Type Rigidified Inflatable Structure for Housing," 10th Multidisciplinary Analysis and Optimization Conference, Albany, NY, Aug - Sept 2004.
* Khire, R. A., Van Dessel, S. and Messac, A., "Active Building Envelopes: A New Solar Driven Heat Transfer Mechanism," 19th European PV Solar Energy Conference, Paris, France, June, 2004.
* Van Dessel, S., Messac, A., and Khire, R., “Active Building Envelopes: A Preliminary Analysis”, Proceedings of the Asia Renewable Energy Conference, Beijing, China, April 2004.
* Khire, R.A., Kandlikar, S.G., Walter, W.W., Raisanen, A., and Sahin, F., “Thermal Management of a Polyimide V-groove Leg Actuator for a Walking Micro-Robot,” 2003 ASME International Mechanical Engineering Congress, DC, Nov. 2003.
* Khire, R.A., Kandlikar, S.G., and Walter, W.W., “Computer Simulated Transient Analysis of a Polyimide V-Groove Leg Actuator with Serpentine Heater for a Walking Micro-Robot,” 1st World Congress on Biomimetics and Artificial Muscles, Albuquerque, NM, Dec. 2002.

**Immigration Status:** US permanent resident since 2012.