

Hugh R. Medal

Curriculum Vitae
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Education and qualifications

2006 B.Sc.(Hons) Industrial Engineering North Dakota State University
2008 M.S. Industrial Engineering University of Arkansas
2012 Ph.D. Industrial Engineering University of Arkansas

Employment history

2018– **Assistant Professor**, Department of Industrial & Systems Engineering, University of Tennessee
2012–2018 **Assistant Professor**, Department of Industrial & Systems Engineering, Mississippi State University

Honors and awards

2018 Article selected as Best Application Paper in the IISE Transactions Focus Issue
2016 Article featured in Research Highlights section of IISE Magazine

Current memberships

- Member, Institute of Industrial and Systems Engineers (IISE, formerly IIE)
- Member, Institute for Operations Research and the Management Sciences (INFORMS)
- Member, Alpha Pi Mu

Research

- My current research involves using machine-learning based surrogate models to optimize expensive, black-box functions.

Grants

I have acquired (in most cases jointly) about \$4.6 million in external research grants since 2012. External research grants over \$30,000 are listed below.

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|-----------|---|-------------|
| 2013–2016 | Grala, R.K, Varner, J.M., Medal, H.R. (Co-PI), Munn, I.A., Grado, S.C., Cooke III, W.H.. “Benefits and costs of implementing fuel treatments on nonindustrial private forest (NIPF) lands in Mississippi”. <i>Funding from Joint Fire Science Program</i> | \$218,000 |
| 2013–2016 | Medal, H.R. (PI) and Li, X.. “Optimizing the mobility and safety of walk-and-ride systems”. <i>Funding from National Center for Intermodal Transportation and Economic Competitiveness</i> | \$102,988 |
| 2015 | King, R., Medal, H.R. (Senior Personnel). “Using high-performance computing to simulate the vulnerability of wireless communication networks to jamming attacks”. <i>Funding from U.S. Army Engineering Research Development Center</i> | \$106,310 |
| 2015–2016 | Medal, H.R. (PI), Bian, L., Hu, M., Marufuzzaman, M., Zhang, S.. “Large-Scale graph analytics for cyber network vulnerability analysis”. <i>Funding from Pacific Northwest National Laboratory</i> | \$6e+05 |
| 2015–2016 | Medal, H.R. (PI), Gordon, J., Grala, R.K.. “A gap analysis of wildland fire response resources in the United States”. <i>Funding from National Center for Risk and Economic Analysis of Terrorism Events</i> | \$49,967 |
| 2016–2017 | Medal, H.R. (PI), Bian, L., Zhang, S.. “Graph Simulation for Large-Scale NetFlow Analysis”. <i>Funding from Pacific Northwest National Laboratory</i> | \$4e+05 |
| 2016–2017 | King, R., Medal, H.R. (Senior Personnel). “Modeling and Simulation of Wireless Sensor Networks”. <i>Funding from U.S. Army Tank Automotive and Armaments Command</i> | \$180,358 |
| 2016–2019 | King, R., Jaradat, R. Medal, H.R. (Co-PI) Walden, C.. “Computational Prototyping and Proving Ground Environment”. <i>Funding from U.S. Army Engineering Research Development Center</i> | \$2,432,550 |

Teaching

- 6 different courses taught: 3 undergraduate and 3 graduate.
- Developed a new course at Mississippi State University, IE 8763: Stochastic Programming.
- Co-authored a study on students' experiences with open-ended industry projects.
- Nominated for 2017 Bagley College of Engineering Academy of Distinguished Teachers.
- Completed internally funded 2017–8 project titled “Using Mathematical Programming to Create Domino Artwork to Display in Local School”.

Publications

PhD thesis

1. **Medal, H.** (2012). “Locating and Protecting Facilities Subject to Random Disruptions and Attacks”. PhD thesis. Fayetteville, Arkansas: University of Arkansas.

Refereed research papers

1. **Medal, H., Sharp, S., E Pohl, SJ Mason, and C Rainwater** (2011). Models for Reducing the Risk of Critical Networked Infrastructures. *International Journal of Risk Assessment and Management* **15**(2/3), 99–127.
2. **Gedik, R., Medal, H., C Rainwater, E Pohl, and S Mason** (Nov. 2014). Vulnerability Assessment and Re-routing of Freight Trains Under Disruptions: A Coal Supply Chain Network Application. *Transportation Research Part E* **71**, 45–57.
3. **Hernandez, I., JE Ramirez-Marquez, C Rainwater, E Pohl, and Medal, H.** (2014). Robust Facility Location: Hedging Against Failures. *Reliability Engineering and System Safety* **123**, 73–80.
4. **Medal, H., EA Pohl, and MD Rossetti** (2014). A Multi-objective Integrated Facility Location-Hardening Model: Analyzing the Pre- and Post-Disruption Tradeoff. *European Journal of Operational Research* **237**, 257–270.
5. **Medal, H., C Rainwater, E Pohl, and M Rossetti** (2014). A Bi-objective Analysis of the R-All-Neighbor P-Center Problem. *Computers and Industrial Engineering* **72**, 114–128.
6. **Medal, H.** (2016). The wireless network jamming problem subject to protocol interference. *Networks* **67**(2), 111–125.
7. **Medal, H., E Pohl, and M Rossetti** (2016). Allocating Protection Resources to Facilities When the Effect of Protection is Uncertain. *IIE Transactions* **48**(3), 220–234.
8. **Nandi, A. K. and Medal, H.** (2016). Models for removing links in a network to minimize the spread of infections. *Computers and Operations Research* **69**, 10–24.
9. **Nandi, A. K., Medal, H., and Vadlamani, S.** (2016). Interdicting attack graphs to protect organizations from cyber attacks: A bi-level defender–attacker model. *Computers and Operations Research* **75**, 118–131.
10. **Rashidi, E., Parsafard, M., Medal, H., and X Li** (2016). Optimal traffic calming: A mixed-integer bi-level programming model for locating sidewalks and crosswalks in a multimodal transportation network to maximize pedestrians' safety and network usability. *Transportation Research Part E* **91**, 33–50.
11. **Sherwin, M., Medal, H., and S Lapp** (2016). Proactive Cost-Effective Identification and Mitigation of Supply Delay Risks in a Low Volume High Value Supply Chain Using Fault-Tree Analysis. *International Journal of Production Economics* **175**, 153–163.
12. **Vadlamani, S., B Eksioglu, Medal, H., and Nandi, A. K.** (2016). Jamming Attacks on Wireless Networks: A Comprehensive Taxonomical Survey. *International Journal of Production Economics* **172**, 76–94.
13. **Chowdhury, S., Khanzadeh, M., Akula, R., Zhang, F., S Zhang, Medal, H., M Marufuzzaman, and L Bian** (2017). Botnet detection using graph-based feature clustering. *Journal of Big Data* **4**(14).
14. **Hoskins, A., Medal, H., and Rashidi, E.** (2017). Satellite Constellation Design for Forest Fire Monitoring Via a Stochastic Programming Approach. *Naval Research Logistics* **64**(8), 642–661.
15. **Rashidi, E., Medal, H., J Gordon, R Grala, and M Varner** (2017). A maximal covering location-based model for analyzing the vulnerability of landscapes to wildfires: Assessing the worst-case scenario. *European Journal of Operational Research* **258**(3), 1095–1105.
16. **Schweitzer, D., Jafari, R., and Medal, H.** (2017). Analyzing the Vulnerability of an Array of Wireless Access Points. *Computers and Industrial Engineering* **107**, 25–38.
17. **Rashidi, E., Hoskins, A., and Medal, H.** (2018). Mitigating a pyro-terror attack using fuel management. *IIE Transactions* **50**(6), 499–511.
18. **Rashidi, E., Medal, H., and Hoskins, A.** (2018). An attacker-defender model for analyzing the vulnerability of initial attack in wildfire suppression. *Naval Research Logistics* **65**(2), 120–134.
19. **Vadlamani, S., Medal, H., B Eksioglu, and Nandi, A. K.** (2018). A mixed-integer programming approach for optimizing flow jamming attacks. *Computers and Operations Research* **95**, 83–96.

20. Bhuiyan, T. H., Moseley, M., **Medal, H.**, E Rashidi, and R Grala (2019). A stochastic programming model with endogenous uncertainty for incentivizing fuel reduction treatment under uncertain landowner behavior. *European Journal of Operational Research* **277**(2), 699–718.
21. David Schweitzer and **Medal, H.** (2019). Wireless LAN transmitter location under the threat of jamming attacks. *Computers and Operations Research* **106**, 14–27.
22. Hoskins, A. and **Medal, H.** (2019). Stochastic Programming Solution for Placement of Satellite Ground Stations. *Annals of Operations Research*, 1–22.
23. Huff, J. D., Leonard, W., B Smith, K Griendling, and **Medal, H.** (2019). NATO Human View Executable Architectures for Critical Infrastructure Analysis. *Engineering Management Journal*. to appear.
24. Huff, J. D., **Medal, H.**, and KA Griendling (2019). A Model-Based Systems Engineering Approach to Critical Infrastructure Vulnerability Assessment and Decision Analysis. *Systems Engineering* **22**(2), 114–133.
25. Li, X, **Medal, H.**, and X Qu (2019). Connected Infrastructure Network Design Under Additive Service Utilities. *Transportation Research Part B* **120**, 99–124.
26. Bhuiyan, T. H. and **Medal, H.** (2020). Network Design and Facility Protection when the Effect of Protection is Uncertain. *European Journal of Operational Research*.
27. Mike Sherwin, **Medal, H.**, C Mackenzie, and Kennedy J. Brown (2020). An optimized resource allocation approach to identify and mitigate supply chain risks using fault-tree analysis. *IIE Transactions* **52**(2). to appear, 236–254.

Book chapters

1. Vadlamani, S., **Medal, H.**, B Eksioglu, and P Li (June 2014). “Security in Wireless Networks: An Operations Research Oriented Tutorial”. In: ed. by S Butenko, EL Pasiliao, and V Shylo. Vol. 37. NATO Science for Peace and Security. IOS Press, pp. 272–288.

Papers in refereed conference proceedings

1. **Medal, H.**, SJ Gade, D. and Mason, RD Meller, and EA Pohl (May 2008). Pickup and Delivery of Poultry in Rural Networks. In: *2008 Industrial Engineering Research Conference*. Ed. by J Fowler and S Mason. Vancouver, Canada, pp.1897–1902 (CD).
2. **Medal, H.**, MD Rossetti, Varghese, V.M., and EA Pohl (May 2009). A Software Tool for Intermittent Demand Analysis. In: *2009 Industrial Engineering Research Conference*. Ed. by JC Smith and J Geunes. Miami, Florida, pp.1658–1663 (CD).
3. Nandi, A. K. and **Medal, H.** (2013). Link removal models for minimizing the spread of infections in a network. In: *Proceedings of the 8th INFORMS Workshop on Data Mining and Health Informatics (DM-HI 2013)*. Ed. by O Seref, N Serban, and D Zeng. INFORMS.
4. Li, X, **Medal, H.**, and Wang, J. (Jan. 2014). A Network Design Model under Connectivity Constraints with Heterogeneous Services. In: *Proceedings of the 2014 Transportation Research Board Conference*. Washington, D.C.
5. Vadlamani, S., **Medal, H.**, B Eksioglu, and P Li (May 2014). A Bilevel Programming Model for the Wireless Network Jamming Placement Problem. In: *2014 Industrial Engineering Research Conference*. Ed. by Y Guan and H Liao. Montreal, Canada.
6. Heier-Stamm, J, R Burch, and **Medal, H.** (2015). Students’ Experiences with an Open-ended Client Project in a Graduate Course. In: *proceedings of the 112nd ASEE Annual Conference and Exposition*. Seattle, Washington, USA.
7. Bhuiyan, T. H., Nandi, A. K., **Medal, H.**, and M Halappanavar (2016). Minimizing Expected Maximum Risk from Cyber-Attacks with Probabilistic Attack Success. In: *IEEE International Conference on Technologies for Homeland Security*. Waltham, Massachusetts, USA.
8. Hoskins, A. and **Medal, H.** (2016). A Stochastic Programming Approach to Satellite Wildfire Observations. In: *Proceedings of the Industrial and Systems Engineering Research Conference*. Anaheim, CA, United States.
9. Rashidi, E. and **Medal, H.** (2016). Information diffusion in social networks with individual time constraints. In: *Proceedings of the Industrial and Systems Engineering Research Conference*. Anaheim, CA, United States.
10. Schweitzer, D., Jafari, R., and **Medal, H.** (2016). Analyzing the Vulnerability of a Single-Hop Wireless Network Grid. In: *Proceedings of the Industrial and Systems Engineering Research Conference*. Anaheim, CA, United States.
11. Zhang, F., S Zhang, PC Wong, **Medal, H.**, L Bian, Y Wang, JE Swan, and TJ Jankin-Kelly (2017). A Visual Evaluation Study of Graph Sampling Techniques. In: *IS&T International Symposium on Electronic Imaging*. Society for Imaging Science and Technology, pp.110–117.

Working papers under revision or review

1. Bhuiyan, T. H., Nandi, A. K., **Medal, H.**, and M Halappanavar (2019). *Risk-averse Bi-level Stochastic Network Interdiction Model for Cyber-security*. Tech. rep. Knoxville, TN: University of Tennessee.

2. Hoskins, A. and **Medal, H.** (2020). *Initial Orbit Selection For Forest Fire Monitoring with Descending Pass Observations*. Tech. rep. Knoxville, TN: University of Tennessee - Knoxville.
3. Mike Sherwin, **Medal, H.**, and C Mackenzie (2020). *Predicting Supplier Reliability in a Low Volume High Value Supply Chain Using Machine Learning*. Tech. rep. Knoxville, TN: University of Tennessee.
4. Rui Zhou, Bhuiyan, Tanveer Hossain, Michael Sherwin, and **Medal, H.** (2020). *A stochastic programming model with endogenous uncertainty for proactive supplier risk mitigation of low-volume-high-value manufacturers considering decision-dependent supplier performance*. Tech. rep. Knoxville, TN: University of Tennessee - Knoxville.

Mentoring and Advising

- Chaired and graduated 6 Ph.D. students, 2 MS students; also supervised one research associate.
- I was nominated for the Outstanding Graduate Student Mentor Award in 2014 and 2015 at Mississippi State University.
- I enjoy doing research with undergraduate students and have supervised 12 of them during my career

Dissertation Chair

- 2015 Models for wireless network jamming and eavesdropping, Satish Vadlamani
- 2015 Optimization models and algorithms for vulnerability analysis...of pyro-terrorism, Eghbal Rashidi
- 2016 Network interdiction models and algorithms for information Security, Apurba Nandi
- 2017 Stochastic optimization for satellite forest fire monitoring, Aaron Hoskins
- 2017 A novel approach to critical infrastructure vulnerability analysis..., Johnathon Huff
- 2018 Optimal supply chain risk reduction using fault trees and mixed-integer programming, Mike Sherwin
- 2019 A three-layered robustness analysis of cybersecurity: attacks and insights, David Schweitzer

#Service

Internal to University of Tennessee

- 2018 Member of UTK ISE faculty search committee
- 2018 Member of Tickle College of Engineering Awards Committee

External

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| 2019–2019 | Chair | INFORMS Doctoral Student Colloquium |
| 2017–2019 | Council member, Operations Research Division | Institute of Industrial and Systems Engineers |
| 2014–2014 | Competition judge | Doing Good with Good OR Competition |
| 2013–2014 | Proposal referee | Various agencies |
| 2013–2013 | Research project report referee | STRIDE Center, Univ. of FL |
| 2012– | Ad-hoc conference proceedings referee | Various conferences |
| 2012– | Session chair | Various conferences |
| 2011– | Ad-hoc journal referee | Various journals |

Outreach

- 2013 Presented research to City of Starkville Transportation Committee
- 2014 Taught module in A.P. Calculus class at Starkville High School on game theory
- 2015 Organized ISE portion of E-Day (high school recruitment event) at Miss. St. Univ.
- 2019 Mentor for the UTK HITES12 Summer Program for Rising High-School Seniors