

# Tayebah Bahreini

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## Research interests

- ✓ Distributed systems
  - ✓ Cloud Computing
  - ✓ Edge computing
  - ✓ Parallel computing
  - ✓ Approximation algorithms
  - ✓ Internet of Things (IoT)
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## Education

- Postdoctoral Research Scientist**, IBM Research YORKTOWN, , NY (2022 – 2024)  
Research Topic: *Workload Management: Chasing Renewable Sources in Multi-cluster Environments*  
Mentor: Dr. Asser Tantawi
- Ph.D. in Computer Science**, Wayne State University DETROIT, MI (2015 – 2021)  
GPA: 4/4  
Dissertation: *Resource Management in Edge Computing Systems*  
Advisor: Dr. Daniel Grosu
- M.Sc. in Computer Engineering**, Shahed University TEHRAN, IRAN (2013–2014)  
GPA: 18.10/20  
Thesis: *Scheduling Quantum Circuits in Ion Trap*
- B.Sc. in Computer Science**, University of Isfahan ISFAHAN, IRAN (2005–2009)  
GPA: 15.10/20  
Thesis: *An Emotion Recognition System for Persian Texts*
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## Research Experience

- Postdoctoral Research Scientist**, IBM Research YORKTOWN, , NY ( 2022 – 2024)  
*Design of sustainable solutions for resource management problems in multi-cluster Kubernetes environments.*
- Multi-cluster Caspian: a prototype for carbon-aware workload dispatching in multi-cluster Kubernetes environments using multi-cluster management platforms such as KubeStellar and MCAD.
  - Multi-node Caspian: A carbon-aware dispatcher within a multi-zone Kubernetes cluster using queuing platforms such as Kueue.
  - Coiba: A framework for carbon-aware global load balancing and horizontal pod auto-scaling in multi-cluster Kubernetes environments.
  - CaLB: A cluster load balancer designed for sustainable query distribution to inferencing services in multi-zone clusters where zones are located in same proximity but powered from different sources of energy.
- Research Summer Intern**, IBM Research YORKTOWN, , NY (SUMMER 2021)  
*Scheduling and placement of workloads in deterministic and non-deterministic cloud environments.*
- Developed MILP optimization models for various versions of the deterministic problem. Developed and implemented optimization algorithms using techniques such as greedy, LP-based approximation, and Benders decomposition to address the problems.
  - Developed a multi-stage stochastic optimization model considering uncertainties of workload arrivals as well as future carbon intensity of electricity sources. Developed and implemented an online algorithm based on sample average approximation method.
- Graduate Research Assistant**, Wayne State University DETROIT, MI ( 2019–2020)  
*NSF grant IIS-1724227: Autonomous battery operating System (ABOS).*
- Studied theoretical aspects of routing and recharging problem and developed a parallel  $(\Delta, \Gamma)$ -stepping algorithm for the constrained shortest path problem.
  - Developed cost-aware efficient algorithms for routing and recharging of electric vehicles.

## Teaching Experience

- **Instructor:** CSC2200-Computer Science II, Wayne State University, Spring/Summer 2018.
- **Instructor:** CSC3110-Algorithm Design and Analysis, Wayne State University, Spring/Summer 2017.
- **Instructor:** CSC2201-Computer Science II Lab, Wayne State University, Fall 2016, Winter 2017, Fall 2017, Spring/Summer 2018, Fall 2018, Winter 2019.
- **Teaching Assistant:** CSC6220-Parallel Computing I: Programming, Fall 2016, Fall 2017, Fall 2018, and Fall 2019.
- **Teaching Assistant:** CSC7220-Parallel Computing II: Algorithms and Applications, Winter 2017, Winter 2018, Winter 2019, and Winter 2020.
- **Grader:** CSC6220-Parallel Computing I: Programming, Fall 2020.

## Honors

Selected to participate in the <b>Rising Stars in Electrical Engineering and Computer Science Workshop</b> at the University of California, Berkeley	2020
Scholarship to attend ACM Richard Tapia Celebration of Diversity in Computing Conference	2020
Selected to participate in the <b>8th Heidelberg Laureate Forum</b>	2020
<b>Ralph H. Kummeler Distinguished Achievement Award in Graduate Student Research</b> - Wayne State University	2020
Outstanding Graduate Research Assistant Award - Wayne State University	2020
Summer Dissertation Award - Wayne State University	2020
Selected as one of the " <b>Top 10 Women in Edge</b> " - Edge Computing World	2019
<b>Finalist, "Edge Woman of the Year 2019 Award"</b> - Edge Computing World	2019
<b>National Center for Women &amp; IT Collegiate Award</b> - National Center for Women & IT	2019
NSF Student Travel Grant - ACM/IEEE SEC 2018	2018
NSF Student Travel Grant - ACM/IEEE SEC 2017	2017
Scholarship to attend ACM HPDC 2017 - HPDC	2017
Scholarship to attend IPDPS 2017 PhD Forum - IPDPS	2017
Outstanding Graduate Teaching Assistant Award - Wayne State University	2017
Best Poster Award at MICWIC 2017 - Michigan State University	2017
Scholarship to attend Grace Hopper Celebration of Women in Computing - GHC	2016
Scholarship to attend CRA-W Grad Cohort - CRA-W	2016
Thomas C. Rumble University Graduate Fellowship - Wayne State University	2015
Ranked first among the graduate students in the Computer Engineering Department - Shahed University	2014

## Journal Articles

- J1. VECMAN: A Framework for Energy-Aware Resource Management in Vehicular Edge Computing Systems  
T. Bahreini, M. Brocanelli, and D. Grosu  
**IEEE Transactions on Mobile Computing**, vol. 22, no. 2, pp. 1231-1245, 2023.
  - J2. Mechanisms for Resource Allocation and Pricing in Mobile Edge Computing Systems  
T. Bahreini, H. Badri, and D. Grosu  
**IEEE Transactions on Parallel and Distributed Systems**, vol. 33, no. 3, pp. 667-682, 2022.
  - J3. Efficient Algorithms for Placement of Multi-Component Applications in Mobile Edge Computing  
T. Bahreini and D. Grosu  
**IEEE Transactions on Cloud Computing**, vol. 10, no. 4, pp. 2550-2563, 2022
  - J4. A Parallel Randomized Approximation Algorithm for the Non-Preemptive Single Machine Scheduling Problem  
H. Badri, T. Bahreini, and D. Grosu  
**Computers & Operations Research**, vol. 130, Art. 105238, 2021.
  - J5. A Congestion-aware Mixed Integer Linear Programming Model for Placement and Scheduling of Quantum Circuits with a Two-level Heuristic Solution Approach  
T. Bahreini and N. Mohammadzadeh **Quantum Engineering**, vol. 3, no. 1, pp. e57, 2021.
  - J6. Energy-Aware Application Placement in Mobile Edge Computing: A Stochastic Optimization Approach  
H. Badri, T. Bahreini, D. Grosu, and K. Yang.  
**IEEE Transactions on Parallel and Distributed Systems**, vol. 31, no. 4, pp. 909-922, 2020.
  - J7. An MINLP Model for Scheduling and Placement of Quantum Circuits with a Heuristic Solution Approach  
T. Bahreini and N. Mohammadzadeh  
**ACM Journal on Emerging Technologies in Computing Systems**, vol. 12, no. 3, pp. 29:1-29:20, 2015.
  - J8. Optimal ILP-based Approach for Gate Location Assignment and Scheduling in Quantum Circuits  
N. Mohammadzadeh, T. Bahreini, and H. Badri  
**Modelling and Simulation in Engineering**, vol. 2014, Article ID 571374, 8 pages, 2014.
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## Refereed Conference Papers

- C1. A Carbon-aware Workload Dispatcher in Cloud Computing Systems  
T. Bahreini, A. Tantawi, and A. Youssef  
Proc. of **2023 IEEE 16th International Conference on Cloud Computing (CLOUD)**, pp. 212-218, Chicago, IL, USA, July 2-8, 2023.
- C2. Brief Announcement: A Parallel  $(\Delta, \Gamma)$ -Stepping Algorithm for the Constrained Shortest Path Problem  
T. Bahreini, D. Grosu, and N. Fisher  
Proc. of **Proceedings of the 34th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 22)**, pp. 287-289, Philadelphia, PA, USA, July 11-14, 2022.
- C3. An Approximation Algorithm for Minimizing the Cloud Carbon Footprint through Workload Scheduling  
T. Bahreini, A. Tantawi, and A. Youssef  
Proc. of **2022 IEEE 15th International Conference on Cloud Computing (CLOUD)**, pp. 522-531, Barcelona, Spain, July 11-15, 2022.
- C4. An Efficient Algorithm for Routing and Recharging of Electric Vehicles  
T. Bahreini, N. Fisher, and D. Grosu  
Proc. of **The 14th Annual International Conference on Combinatorial Optimization and Applications (COCOA 2020)**, virtual conference, December 11-13, 2020.
- C5. Risk-Aware Application Placement in Mobile Edge Computing Systems: A Learning-based Optimization Approach  
H. Badri, T. Bahreini, D. Grosu, and K. Yang  
Proc. of **The IEEE International Conference on Edge Computing (IEEE EDGE 2020)**, virtual conference, October 19-23, 2020.
- C6. Energy-Aware Resource Management in Vehicular Edge Computing Systems  
T. Bahreini, M. Brocanelli, and D. Grosu  
Proc. of **The IEEE International Conference on Cloud Engineering (IC2E 2020)**, pp. 49-58, Sydney, Australia, April 21-24, 2020.

- C7. Energy-Aware Capacity Provisioning and Resource Allocation in Mobile Edge Computing Systems  
T. Bahreini, H. Badri, and D. Grosu  
Proc. of **The International Conference on Edge Computing (EDGE 2019)**, pp. 31-45, San Diego, CA, June 25-30, 2019.
- C8. Energy-Aware Speculative Execution in Vehicular Edge Computing Systems  
T. Bahreini, M. Brocanelli, and D. Grosu  
Proc. of **The 2nd ACM EuroSys International Workshop on Edge Systems, Analytics and Networking (EdgeSys 2019)**, pp. 18-23, Dresden, Germany, March 25, 2019.
- C9. An Envy-Free Auction Mechanism for Resource Allocation in Edge Computing Systems  
T. Bahreini, H. Badri, and D. Grosu  
Proc. of **The Third ACM/IEEE Symposium on Edge Computing (SEC 2018)**, pp. 313-322, Bellevue, WA, October 25-27, 2018.
- C10. A Sample Average Approximation-Based Parallel Algorithm for Application Placement in Edge Computing Systems  
H. Badri, T. Bahreini, D. Grosu, and K. Yang  
Proc. of **The IEEE International Conference on Cloud Engineering (IC2E 2018)**, pp. 198-203, Orlando, FL, April 17-20, 2018.
- C11. Efficient Placement of Multi-Component Applications in Edge Computing Systems  
T. Bahreini and D. Grosu  
Proc. of **The Second ACM/IEEE Symposium on Edge Computing (SEC 2017)**, pp. 5:1-5:11, San Jose, CA, October 12-14, 2017.
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## Working Papers

1. Caspian: A Carbon-aware Workload Scheduler in Multi-Cluster Kubernetes Environments  
T. Bahreini, A. Tantawi, and O. Tardieu  
Proc. of **32nd International Symposium on the Modeling, Analysis, and Simulation of Computer and Telecommunication Systems**, Krakow, Poland, October 21-23, 2024 (Under Review).
  2. Parallel Shifting Bottleneck Algorithms for Flow Shop Scheduling  
H. Badri, T. Bahreini, and D. Grosu  
**Annals of Operations Research** (Under Review).
  3. Coiba: A Carbon Optimized Inference Load Balancer in Multi-Cloud Environments  
T. Bahreini, A. Tantawi, and K. Narayanam  
**IEEE Transactions on Cloud Computing**.
  4. Electric Vehicle Routing and Charging with Heterogeneous Prices  
T. Bahreini, N. Fisher, and D. Grosu  
**IEEE Transactions on Intelligent Transportation Systems**.
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## Patents

1. Multi-Cluster Carbon-Aware Balancing  
K. Narayanam, A. Tantawi, A. Youssef, and T. Bahreini,  
US Patent pending (filed March 2024)
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## Talks

- T1. CASPIAN: A Carbon-Optimized Multi-Cluster Job Scheduler  
T. Bahreini and A. Tantawi  
**KubeCon+ CloudNativeCon Europe**, Paris, France, March 19-24, 2024.
- T2. A carbon-aware workload dispatcher in multi-cluster Kubernetes environments  
T. Bahreini and A. Tantawi  
**CNCF Cloud Native Sustainability Week**, virtual conference, October 9, 2023.

- T3. Minimizing the Cloud Carbon Footprint through Workload Scheduling  
T. Bahreini, A. Tantawi, and A. Youssef  
**IBM-Columbia Sustainable Computing Workshop**, Columbia University, New York, May 24, 2022.
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## Posters

- P1. Workload Optimization: Minimal Carbon Footprint  
T. Bahreini, A. Tantawi, and R. Kolluri  
**2021 Global Research Intern and Extern Poster Session, IBM**, virtual conference, August 9-12, 2021.
- P2. VECMAN: A Framework for Energy-Aware Resource Management in VEC Systems  
T. Bahreini  
**Rising Stars in Electrical Engineering and Computer Science 2020 Workshop at the University of California, Berkeley**, virtual conference, November 9-10, 2020.
- P3. Resource Management in Edge Computing Systems  
T. Bahreini  
**ACM Richard Tapia Celebration of Diversity in Computing Conference (Tapia 2020), Doctoral Consortium**, virtual conference, September 16-18, 2020.
- P4. Energy-Aware Speculative Execution in Vehicular Edge Computing Systems  
T. Bahreini, M. Brocanelli, and D. Grosu  
**The 2nd Metro Detroit Workshop on Connected and Autonomous Driving (MetroCAD 2019)**, Detroit, MI, March 1, 2019.
- P5. Risk-based Optimization of Resource Provisioning in Mobile Edge Computing  
H. Badri, T. Bahreini, and D. Grosu  
**The Third ACM/IEEE Symposium on Edge Computing (SEC 2018)**, Bellevue, WA, October 25-27, 2018
- P6. Multi-stage Stochastic Programming for Service Placement in Edge Computing Systems  
H. Badri, T. Bahreini, D. Grosu, and K. Yang  
**The Second ACM/IEEE Symposium on Edge Computing (SEC 2017)**, San Jose, CA, October 12-14, 2017.
- P7. Efficient Placement of Multi-Component Services in Edge Computing Systems  
T. Bahreini and D. Grosu  
**ACM Symposium on High-Performance Parallel and Distributed Computing (HPDC 2017)**, Washington DC, June 26-30, 2017.
- P8. Efficient Placement of Multi-Component Services in Edge Computing Systems  
T. Bahreini and D. Grosu  
**The 31st IEEE International Parallel & Distributed Processing Symposium (IPDPS 2017), PhD Forum**, Orlando, FL, May 29 - June 2, 2017.
- P9. A Heuristic Algorithm for Multi-Component Application Placement in Edge Computing  
T. Bahreini and D. Grosu  
**The 6th biennial Michigan Celebration of Women in Computing (MICWIC 2017)**, Michigan State University, Lansing, MI, 31 March 31 - April 1, 2017.  
**\* Best Poster Award**
- P10. Heuristic Algorithms for Coflow Scheduling in Data Centers  
T. Bahreini and D. Grosu  
**The Grace Hopper Celebration of Women in Computing Conference (GHC 2016), Poster Session**, Houston, TX, October 3-6, 2016.

## Professional Service

- **Reviewer**

- IEEE Transactions on Cloud Computing
  - IEEE Transactions on Mobile Computing
  - IEEE Transactions on Sustainable Computing
  - IEEE Transactions on Parallel and Distributed Systems
  - 5th IEEE International Conference on Fog and Edge Computing (ICFEC 2021)
  - IEEE International Conference on Cloud Computing (IEEE CLOUD 2020)
  - International Symposium on Parallel and Distributed Computing (ISPDC 2019)
  - IEEE International Conference on Cloud Computing (IEEE CLOUD 2019)
  - IEEE International Conference on Edge Computing (IEEE EDGE 2019)
  - 3rd IEEE International Conference on Fog and Edge Computing (ICFEC 2019)
  - 15th IEEE International Symposium on Parallel and Distributed Processing with Applications (ISPA 2017)
  - IEEE International Conference on Edge Computing (IEEE EDGE 2018)
  - IEEE International Conference on Cloud Computing (IEEE CLOUD 2017)
  - 17th International Conference on Algorithms and Architectures for Parallel Processing (ICA3PP 2017)
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## Professional Affiliation

- ACM (Association for Computing Machinery)
  - ACM-W (Association for Computing Machinery-Women)
  - IEEE (Institute of Electrical and Electronics Engineers)
  - IEEE Computer Society
  - INFORMS (Institute for Operations Research and the Management Sciences)
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## References

- **Daniel Grosu**  
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- **Asser Tantawi**  
Research Staff Member  
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E-mail: tantawi@us.ibm.com
- **Nathan Fisher**  
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