# Tayebeh Bahreini

## Research interests

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| ✓ 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 for multi-zone Kubernetes clusters 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.

**Research Summer Intern**, IBM Research                                   Yorktown, , NY (Summer 2021)
*Carbon-aware scheduling and placement of workloads in 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 solve 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 the 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 the problem of routing and recharging of electrical vehicles 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

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| Received the **2021 IEEE TCSC (Technical Committee on Scalable Computing) Outstanding Ph.D Dissertation Award** | 2021 |
| Selected to participate in the **Rising Stars in Electrical Engineering and Computer Science Workshop** 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 **8th Heidelberg Laureate Forum** | 2020 |
| **Ralph H. Kummler Distinguished Achievement Award in Graduate Student Research** - 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 **"Top 10 Women in Edge"** - Edge Computing World | 2019 |
| **Finalist, "Edge Woman of the Year 2019 Award"** - Edge Computing World | 2019 |
| **National Center for Women & IT Collegiate Award** - 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. Parallel Shifting Bottleneck Algorithms for Flow Shop Scheduling
H. Badri, T. Bahreini, and D. Grosu
**Annals of Operations Research** (accepted).

J2. 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.

J3. 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.

J4. 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

J5. 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.

J6. 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.

J7. 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.

J8. 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.

J9. 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. Caspian: A Carbon-aware Workload Scheduler in Multi-Cluster Kubernetes Environments
T. Bahreini, A. Tantawi, and O. Tardieu
Proc. of **The 32nd IEEE International Symposium on the Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS 2024)**, Krakow, Poland, October 21-23, 2024.

C2. A Carbon-aware Workload Dispatcher in Cloud Computing Systems
T. Bahreini, A. Tantawi, and A. Youssef
Proc. of **The IEEE 16th International Conference on Cloud Computing (CLOUD 2023)**, pp. 212-218, Chicago, IL, USA, July 2-8, 2023.

C3. Brief Announcement: A Parallel $(\Delta, \Gamma)$-Stepping Algorithm for the Constrained Shortest Path Problem
T. Bahreini, D. Grosu, and N. Fisher
Proc. of **The 34th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 22)**, pp. 287-289, Philadelphia, PA, USA, July 11-14, 2022.

C4. An Approximation Algorithm for Minimizing the Cloud Carbon Footprint through Workload Scheduling
T. Bahreini, A. Tantawi, and A. Youssef
Proc. of **The IEEE 15th International Conference on Cloud Computing (CLOUD 2022)**, pp. 522-531, Barcelona, Spain, July 11-15, 2022.

C5. 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.

C6. 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.

C7. 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.

C8. 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, USA, June 25-30, 2019.

C9. 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.

C10. 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.

C11. 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.

C12. 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.

## Working Papers

1. Coiba: A Carbon Optimized Inference Load Balancer and Horizontal Autoscaler in Multi-Cluster Kubernetes Environments
T. Bahreini, A. Tantawi, and K. Narayanam
**IEEE Transactions on Cloud Computing** (to be submitted).

2. A Parallel $(\Delta, \Gamma)$-Stepping Algorithm for the Constrained Shortest Path Problem
T. Bahreini, D. Grosu, and N. Fisher
**ACM Transactions on Parallel Computing** (to be submitted).

## Patents

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

## 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
  - IEEE/ACM Transactions on Networking
  - 12th IEEE International Conference on Cloud Engineering (IC2E 2024)
  - 10th IEEE International Conference on Cloud Engineering (IC2E 2022)
  - 6th IEEE International Conference on Fog and Edge Computing (ICFEC 2022)
  - 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)