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## BIOGRAPHICAL SKETCH

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NAME: Mohammad Tradat

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CONTACT: mtradat1@binghamon.edu

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POSITION TITLE: **Research Scientist**

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### EDUCATION/TRAINING

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INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Jordan University of Science and Technology, Irbid, Jordan	B. Sc.	06/2003	Mechanical Engineering
Jordan University of Science and Technology, Irbid, Jordan	M.Sc.	05/2015	Mechanical Engineering
SUNY Binghamton, NY	Ph.D.	05/2019	Mechanical Engineering
SUNY Binghamton, NY	Post Doc Associate	2019-2021	Mechanical Engineering
SUNY Binghamton, NY	Research Scientist	2021-Ongoing	Mechanical Engineering

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### Positions and Honors

#### Positions and Employment:

2003-Feb 2006	Maintenance Supervisor Engineer, Al Tayer Group, United Arab Emirates
April 2006 - March 2016	Mechanical Engineer, Jordan Armed Forces, Jordan
July 2016- May 2019	Research Assistant, Center for Energy Smart-Electronics Systems, Mechanical Engineering department and Research Foundation, SUNY Binghamton
July 2019- Jan. 2021	Post-Doctoral Associate, Center for Energy Smart-Electronics Systems, Mechanical Engineering department and Research Foundation, SUNY Binghamton
Jan. 2021 - Present	Research Scientist, Mechanical Engineering department and Research Foundation, SUNY Binghamton

#### Awards and Professional Memberships:

- Distinguished dissertation award of Small-Scale Systems Integration and Packaging (2019).
- Best paper award of Energy –Smart and Electronic Systems at Semi-Therm, San Jose, CA. (2017).
- Best poster award of ES2 Industrial Advisory Board Meeting, Binghamton, NY. (2018).
- Best poster award of ES2 Industrial Advisory Board Meeting, Villanova, PA. (2017).
- Best poster award of Electronic Packaging Symposium, Binghamton, NY. (2018).
- Seventeen Technical articles; presentations in data centers related conferences (ITherm, Semi-Therm, InterPack). 11 poster presentations in data center and electronic packaging related conferences and symposiums.

#### Contributions to Science:

##### **Thermal management of Data centers – Binghamton University**

To enhance the knowledge and contribute to the existing field of data center thermal management including heat transfer, fluid dynamics and energy management, I have the following major contributions as an outcome from my research and development:

1. Through my Doctor of Philosophy journey, I have developed an understanding and presented a quantitative and qualitative comparison of air-cooled data centers monitoring methods that filled a remarkable knowledge gap in the available literature in the field of data center thermal management. In addition, the impact of pressure relief on IT equipment was addressed for

the first time in the literature. Moreover, I have developed experimental facilities and methodologies to characterize and improve data center energy efficiency through transient and steady studies.

2. One more contribution I have in science to the field of data center cooling using air cooled heat sink, single phase liquid and two-phase cold plates from chip to facility levels. Under the National Science Foundation grant I have collaborated with students and scholars in my research group to:
  - a. Conceptualize and develop a novel solution for energy efficiency enhancement in data centers using porous partitions in the plenum for air-cooled raised floor data centers. Also, demonstration of generalized approach and make it easily adopted in existing and future data centers.
  - b. Developed and built a novel experimental methodology that characterizes fan performance more accurately in high resistive environments.
  - c. Develop and test a novel fuzzy control system toward self-sensing, self-regulated airflow management through enhanced a control algorithm for VFD of CRAH units based on the pressure measurements in the plenum for multi-cold aisles.
  - d. Conceptualize and develop more accurate compact model of IT equipment for data centers energy planning using Machine Learning assessment for full physics based CFD modeling.
  - e. Conceptualized and supervised undergraduate senior project titled "Autonomous Robot for Monitoring and Control of Data Centers". The project was presented in the 2020 University Challenge, the 7x24 Metro NY Chapter and won a \$5000 grant for Binghamton University, as well as \$250 gift cards to each student. [see [here](#)].

- a. Tradat, M. I., Sammakia, B. G., Hoang, C. H., & Alissa, H. A. (2021). An experimental and numerical investigation of novel solution for energy management enhancement in data centers using underfloor plenum porous obstructions. *Applied Energy*, 289, 116663.
- b. Manaserh, Y. M., Tradat, M. I., Hoang, C. H., Sammakia, B. G., Ortega, A., Nemat, K., & Seymour, M. J. (2021). Degradation of Fan Performance in Cooling Electronics: Experimental Investigation and Evaluating Numerical Techniques. *International Journal of Heat and Mass Transfer*, 174, 121291.
- c. Tradat, M., Mohsenian, G., Manaserh, Y., Sammakia, B., Mendo, D., & Alissa, H. A. (2020, July). Experimental Analysis of Different Measurement Techniques of Server-Rack Airflow Predictions Towards Proper DC Airflow Management. In 2020 19th IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (ITherm) (pp. 366-373). IEEE.
- d. Khalili, S., Alissa, H. A., Tradat, M. I., Nemat, K., Sammakia, B., & Seymour, M. (2017, March). Experimental methods to characterize the impact of cross flow orientation on jets of air after a perforated tile. In 2017 33rd Thermal Measurement, Modeling & Management Symposium (SEMI-THERM) (pp. 163-171). IEEE.
- e. Hoang, Cong Hiep, et al. "Liquid Cooling Utilizing a Hybrid Microchannel/Multi-Jet Heat Sink: A Component Level Study of Commercial Product." ASME 2020 International Technical Conference and Exhibition on Packaging and Integration of Electronic and Photonic Microsystems. American Society of Mechanical Engineers Digital Collection, 2020.
- f. Ramakrishnan, Bharath, et al. "Characterization of Liquid Cooled Cold Plates for a Multi Chip Module (MCM) and their Impact on Data Center Chiller Operation." 2019 IEEE 17th International Conference on Industrial Informatics (INDIN). Vol. 1. IEEE, 2019.
- g. Hoang, C. H., Rangarajan, S., Radmard, V., Fallahtafti, N., Tradat, M., Arvin, C., ... & Sammakia, B. (2021, June). Two-phase Impingement Cooling using a Trapezoidal Groove Microchannel Heat Sink and Dielectric Coolant HFE 7000. In 2021 20th IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (iTherm) (pp. 237-245). IEEE.

#### List of Journal publications from Binghamton University research

1. Tradat, Mohammad I., Bahgat G. Sammakia, Cong Hiep Hoang, and Husam A. Alissa. "An experimental and numerical investigation of novel solution for energy management enhancement in data centers using underfloor plenum porous obstructions." *Applied Energy* 289 (2021): 116663.
2. Manaserh, Yaman, Mohammad I. Tradat, Cong Hiep Hoang, Bahgat G. Sammakia, Alfonso Ortega, Kourosh Nemat, and Mark J. Seymour. "Degradation of Fan Performance in Cooling Electronics: Experimental Investigation and Evaluating Numerical Techniques." *International Journal of Heat and Mass Transfer* 174 (2021): 121291.
3. Khalili, Sadegh, Mohammad I. Tradat, Kourosh Nemat, Mark Seymour, and Bahgat Sammakia. "Impact of tile design on the thermal performance of open and enclosed aisles." *Journal of Electronic Packaging* 140, no. 1 (2018).
4. Mohsenian, Ghazal, Sadegh Khalili, Mohammad Tradat, Yaman Manaserh, Srikanth Rangarajan, Anuroop Desu, Dushyant Thakur, Kourosh Nemat, Kanad Ghose, and Bahgat Sammakia. "A novel integrated fuzzy control system toward automated local airflow management in data centers." *Control Engineering Practice* 112 (2021): 104833.
5. Yaman M. Manaserh, Mohammad I. Tradat, Dana Bani-Hani, Aseel Alfallah, Bahgat G. Sammakia, Kourosh Nemat, Mark J. Seymour. "Machine Learning Assisted Development of IT Equipment Compact Models for Data Centers Energy Planning." Accepted at *Applied Energy* – In Press.

6. Yaman Manaserh, **Mohammad. I. Tradat**, Ahmad. R. Gharaibeh, Bahgat. G. Sammakia, Russ. Tipton. "Shifting to Energy Efficient Hybrid Cooled Data Centers Using Novel Embedded Floor Tiles Heat Exchangers." Accepted in Energy Conversion and Management – In Press.

#### **List of conference publications from BU research**

1. **Tradat, Mohammad I.**, Husam A. Alissa, Kourosh Nemati, Sadegh Khalili, Bahgat G. Sammakia, Mark J. Seymour, and Russell Tipton. "Impact of elevated temperature on data center operation based on internal and external IT instrumentation." (*SEMI-THERM*), pp. 108-114. IEEE, 2017..
2. **Tradat, M.**, S. Khalili, B. Sammakia, M. Ibrahim, Th Peddle, A. Calder, B. Dawson, M. Seymour, K. Nemati, and H. Alissa. "Comparison and evaluation of different monitoring methods in a data center environment." (*IPACK2017*). American Society of Mechanical Engineers, 2017.
3. **Tradat, Mohammad I.**, Udaya LN Puvvadi, Bahgat G. Sammakia, Kanad Ghose, Mahmoud Ibrahim, Andrew Calder, Thomas Peddle, Mark Seymour, and Husam A. Alissa. "The Impact of Cold Aisle Containment Pressure Relief on IT Availability." (*ITHERM*), pp. 944-952. IEEE, 2018.
4. **Tradat, Mohammad**, Bahgat Sammakia, Husam Alissa, and Kourosh Nemati. "Experimental Analysis of Chiller Cooling Failure in a Small Size Data Center Environment Using Wireless Instrumentation." (*IPACK2018*), vol. 51920, p. V001T02A006. American Society of Mechanical Engineers, 2018.
5. **Tradat, Mohammad I.**, Sadegh Khalili, Malek Khatabi, Bahgat G. Sammakia, Mark Seymour, Russel Tipton, and Husam A. Alissa. "Numerical Investigation of Novel Underfloor Air-Directors Effect on Data Center Performance." (*ITHERM*), pp. 886-896. IEEE, 2019.
6. **Tradat, Mohammad**, Ghazal Mohsenian, Yaman Manaserh, Bahgat Sammakia, Dave Mendo, and Husam A. Alissa. "Experimental Analysis of Different Measurement Techniques of Server-Rack Airflow Predictions Towards Proper DC Airflow Management." (*ITHERM*), pp. 366-373. IEEE, 2020.
7. Manaserh Yaman, **Mohammad I. Tradat**, Ghazal Mohsenian, Bahgat G. Sammakia, Alfonso Ortega, Mark J. Seymour, and Kourosh Nemati. "Novel Experimental Methodology for Characterizing Fan Performance in Highly Resistive Environments." (*ITHERM*), pp. 1-7. IEEE, 2020.
8. Manaserh Yaman, **Mohammad I. Tradat**, Ghazal Mohsenian, Bahgat G. Sammakia, and Mark J. Seymour. "General guidelines for commercialization a small-scale in-row cooled data center: a case study." (*SEMI-THERM*), pp. 48-55. IEEE, 2020.
9. Khalili, Sadegh, **Mohammad Tradat**, Bahgat Sammakia, Husam Alissa, and Cheng Chen. "Impact of Fans Location on the Cooling Efficiency of IT Servers." (*ITHERM*), pp. 1266-1274. IEEE, 2019.
10. Ramakrishnan, Bharath, **Mohammad Tradat**, Yaser Hadad, Kanad Ghose, and Bahgat Sammakia. "Characterization of Liquid Cooled Cold Plates for a Multi-Chip Module (MCM) and their Impact on Data Center Chiller Operation." (*INDIN*), vol. 1, pp. 1419-1424. IEEE, 2019.
11. Hoang, Cong Hiep, **Mohammad Tradat**, Yaman Manaserh, Bharath Ramakrisnan, Srikanth Rangarajan, Yaser Hadad, Scott Schiffres, and Bahgat Sammakia. "Liquid Cooling Utilizing a Hybrid Microchannel/Multi-Jet Heat Sink: A Component Level Study of Commercial Product." (*IPACK2020*). American Society of Mechanical Engineers Digital Collection, 2020.
12. Khalili, Sadegh, Husam A. Alissa, **Mohammad I. Tradat**, Kourosh Nemati, Bahgat Sammakia, and Mark Seymour. "Experimental methods to characterize the impact of cross flow orientation on jets of air after a perforated tile." (*SEMI-THERM*), pp. 163-171. IEEE, 2017.
13. Nemati, Kourosh, Husam A. Alissa, **Mohammad I. Tradat**, and Bahgat Sammakia. "Transient Thermal Performance of Rear Door Heat Exchanger in Local Contained Environment During Water Side Failure." (*IPACK2017*). American Society of Mechanical Engineers Digital Collection, 2017.
14. Hoang, C. H., Rangarajan, S., Radmard, V., Fallahtafti, N., **Tradat, M.**, Arvin, C., ... & Sammakia, B. (2021, June). Two-phase Impingement Cooling using a Trapezoidal Groove Microchannel Heat Sink and Dielectric Coolant HFE 7000. In 2021 20th IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (iTherm) (pp. 237-245). IEEE.

#### **Courses taught**

1. Thermodynamics, Department of mechanical engineering, Summer 2021.
2. Engineering computational methods, Department of mechanical engineering, Summer 2021.
3. Thermodynamics, Department of mechanical engineering, Summer 2020.
4. Engineering computational methods, Department of mechanical engineering, Summer 2020.
5. Design of Experiment, Fall 2020.
6. Applications in Electronics Thermal Managements, Spring 2021.
7. Over three years (2018-2020) give guest lectures in Energy Engineering course, Department of mechanical engineering.

8. Engineering computational methods, Department of mechanical engineering, Fall 2019, joint teaching with Prof. Bruce Murray.
9. Heat and mass transfer, Department of mechanical engineering, Fall 2019, joint teaching with Prof. Scott Shiffers.

### **Graduate Students Mentored**

1. Ghazal Mohsenian.
2. Yaman “Mohammad Ali” Manaserh.
3. Ahmad R Gharaibeh.
4. Hozefa H Lakadawada.

### **Undergraduate Mentored Senior Design Projects**

1. Autonomous Robot for Monitoring and Control of Data Centers (2019 – 2020).
2. Multi-Chip Module Mock Package for Heterogeneous Integration (2019 – 2020).
3. Lithium Battery Thermal Management – Side Wall and Busbar Cooling (2020 – 2021).
4. Thermal Solutions of 3D Stacked-Chip Packages with Conduction Interfaces (Ongoing).
5. Test Bed for Characterizing and Efficiency Evaluation of Strainers and Filters Used for Industrial Cooling Fluids (Ongoing).