
BIOGRAPHICAL SKETCH

NAME: Srikanth Rangarajan

CONTACT: srangar@binghamton.edu

POSITION TITLE: Research Assistant Professor and Visiting Research Scientist

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Sri Sairam Engineering College, Anna University, Chennai, India	B.E	06/2011	Mechanical Engineering
Indian Institute of Technology Madras, Chennai, India	M.S.	06/2017	Mechanical Engineering
Indian Institute of Technology Madras, Chennai, India	Ph.D.	06/2017	Mechanical Engineering
Divecha Centre for Climate change (DCCC) Indian Institute of Science, Bangalore	Post Doc Fellow	2017-2018	Centre for climate change
SUNY Binghamton, NY	Post Doc Fellow	2018 - Ongoing	Mechanical Engineering

Positions and Honors

Positions and Employment:

2011 – 2012	Graduate Engineer Trainee, WABCO INDIA
2012-2017	Research Assistant, Heat Transfer and Thermal Power Lab, Mechanical Engineering Department, Indian Institute of Technology, Madras
2017-2018	Research Associate, Divecha Centre for Climate Change, Indian Institute of Science , Bangalore
2018- Nov 2020	Post-Doctoral Research scholar, Mechanical Engineering department, SUNY Binghamton
Nov 2020-present	Research Assistant professor and Research Scientist Mechanical Engineering department, SUNY Binghamton

Awards and Professional Memberships:

- Appointed as Post-Doctoral research fellow by SUNY Binghamton (2018)
- Awarded the Institute Post-Doctoral fellowship for submission of MS+PhD thesis within 60 months, Indian Institute of Technology Madras, 2017
- Awarded the Research associate position at Divecha Centre for climate change by the Indian Institute of Science 2017
- Awarded the Half-Time Research Assistantship (HTRA) by the Indian Ministry of Human Resource Development (MHRD) as a scholarship to pursue doctoral thesis in Mechanical Engineering, 2013

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Contributions to Science

1. *Thermal management of Data centers – Binghamton University*

One of my contribution to science was in the field of data Centre cooling using air cooled heat sink, single phase liquid and two phase cold plates. Under a Semiconductor Research Corporation (SRC) Grant I have collaborated with students and scholars in my group to develop experimental facilities and optimization methodology to characterize and improve the performance of the currently working designs respectively. An Artificial Neural Network (ANN) combined with Genetic Algorithm was successfully demonstrated for optimization. The experiments were carried about in both server level and rack level. Furthermore, as a part of the same funding project, I demonstrated numerical modelling based optimization of printed fins directly onto the chip

- Khalili, Sadegh, Srikanth Rangarajan, Vadim Gektin, Husam Alissa, and Bahgat Sammakia. "An Experimental Investigation on the Fluid Distribution in a Two-Phase Cooled Rack Under Steady and Transient Information Technology Loads." *Journal of Electronic Packaging* 142, no. 4 (2020).
- Hadad, Yaser, Srikanth Rangarajan, Kourosh Nemati, Bharath Ramakrishnann, Reza Pejman, Paul R. Chiarot, and Bahgat Sammakia. "Performance analysis and shape optimization of a water-cooled impingement micro-channel heat sink including manifolds." *International Journal of Thermal Sciences* 148 (2020): 106145.
- Radmard, Vahideh, Yaser Hadad, Arad Azizi, Srikanth Rangarajan, C. Hiep Hoang, Charles Arvin, Kamal Sikka, Scott N. Schiffres, and Bahgat Sammakia. "Direct Micro-Pin Jet Impingement Cooling for High Heat Flux Applications." In *2020 36th Semiconductor Thermal Measurement, Modeling & Management Symposium (SEMI-THERM)*, pp. 1-9. IEEE, 2020.
- Hoang, Cong Hiep, Sadegh Khalili, Bharath Ramakrisnan, Srikanth Rangarajan, Yaser Hadad, Vahideh Radmard, Kamal Sikka, Scott Schiffres, and Bahgat Sammakia. "An Experimental Apparatus for Two-phase Cooling of High Heat Flux Application using an Impinging Cold Plate and Dielectric Coolant." In *2020 36th Semiconductor Thermal Measurement, Modeling & Management Symposium (SEMI-THERM)*, pp. 32-38. IEEE, 2020.

2. *Phase Change Materials (PCMs) based heat sinks for transient thermal management of electronics- IIT Madras (2012-2017) and Binghamton university (2019 – present)*

- My other contribution to science was design and optimization of PCM based heat sinks for thermal management of transient power spikes in electronics. I was awarded the Half-Time Research Assistantship (HTRA) by the Indian Ministry of Human Resource Development (MHRD) as a scholarship to pursue the research topic. The research aimed at experimental demonstration and optimization of the PCM based heat sink with different configuration fins to control the heat dissipating element's temperature below a safe operating temperature. The study went to be one of the foremost studies that simultaneously considered melting and solidification cycles for optimization of the heat sink design with multiple hotspots (active core regions). Minimizing the time taken for solidification cycle was one among the prime objectives in the study along with extending the temperature control during the melting cycle. Additionally, I went on to develop a novel cylindrical heat sink that could rotate and prolong the operation of microprocessors under safe operating temperature for a longer time. Furthermore, I demonstrated the concept of housing multiple PCMs in a single heat sink for temperature control of transient hotspots in the microprocessor chips. *I still continue to work on phase change material based composites for electronic cooling under a recent SRC research grant at SUNY Binghamton.*

- Srikanth, R., and Chakravarthy Balaji. "Experimental investigation on the thermal performance of a pcm based cylindrical heat sink with multiple pcms." In *International Heat Transfer Conference Digital Library*. Begel House Inc., 2018.

- b. Srikanth, R., and C. Balaji. "Experimental investigation on the heat transfer performance of a PCM based pin fin heat sink with discrete heating." *International Journal of Thermal Sciences* 111 (2017): 188-203.
- c. Srikanth, R., Pavan Nemani, and C. Balaji. "Multi-objective geometric optimization of a PCM based matrix type composite heat sink." *Applied energy* 156 (2015): 703-714.
- d. Sridharan, Srinivas, R. Srikanth, and C. Balaji. "Multi objective geometric optimization of phase change material based cylindrical heat sinks with internal stem and radial fins." *Thermal Science and Engineering Progress* 5 (2018): 238-251.
- e. Srikanth, Rangarajan, Rohit S. Nair, and C. Balaji. "Thermosyphon assisted melting of PCM inside a rectangular enclosure: A synergistic numerical approach." In *Journal of Physics: Conference Series*, vol. 745, no. 3, p. 032130. IOP Publishing, 2016.
- f. Ayushman Singh, Srikanth Rangarajan, Leila Choobineh, Bahgat Sammakia "Effective Thermal conductivity of phase change material-based composites for high heat flux electronic cooling" In ASME 2020 International Technical Conference and Exhibition on Packaging and Integration of Electronic and Photonic Microsystems. American Society of Mechanical Engineers Digital Collection, 2020.

Books:

- Rangarajan, Srikanth, and C. Balaji. *Phase Change Material-based Heat Sinks: A Multi-objective Perspective*. CRC Press, 2019.

Patent(s):

- Srikanth R, C. Balaji "Rotatable heat sink", Indian patent Granted, Patent number 351972

List of Journal publications from Binghamton University research

1. Rangarajan, Srikanth, Yaser Hadad, Leila Choobineh, and Bahgat Sammakia. "Minimizing Temperature Non-Uniformity by Optimal Arrangement of Hotspots in Vertically Stacked Three-Dimensional Integrated Circuits." *Journal of Electronic Packaging* (2020).
2. Khalili, Sadegh, Srikanth Rangarajan, Vadim Gektin, Husam Alissa, and Bahgat Sammakia. "An Experimental Investigation on the Fluid Distribution in a Two-Phase Cooled Rack under Steady and Transient Information Technology Loads." *Journal of Electronic Packaging* 142, no. 4 (2020).
3. Hadad, Yaser, Srikanth Rangarajan, Kourosh Nemati, Bharath Ramakrishnann, Reza Pejman, Paul R. Chiarot, and Bahgat Sammakia. "Performance analysis and shape optimization of a water-cooled impingement micro-channel heat sink including manifolds." *International Journal of Thermal Sciences* 148 (2020): 106145.
4. Hadad, Yaser, Bharath Ramakrishnan, Reza Pejman, Srikanth Rangarajan, Paul R. Chiarot, Arvind Pattamatta, and Bahgat Sammakia. "Three-objective shape optimization and parametric study of a micro-channel heat sink with discrete non-uniform heat flux boundary conditions." *Applied Thermal Engineering* 150 (2019): 720-737.
5. Yaser Hadad, , Vahideh Radmard, Srikanth Rangarajan , Mahdi Farahikia, Gamal Refai-Ahmed, Paul R Chiarot, Bahgat Sammakia," Minimizing the Effects of On-Chip Hotspots Using Multi-Objective Optimization of Flow Distribution in Water-Cooled Parallel Micro-Channel Heat Sinks", *Journal of Electronic Packaging* (2020).

List of conference publications from BU research

1. Rangarajan, Srikanth, Yaser Hadad, Leila Choobineh, and Bahgat Sammakia. "Optimal Arrangement of Multiple Heat Sources in Vertically Stacked Two-Layer 3-D IC Using Genetic Algorithm." In ASME 2019 International Technical Conference and Exhibition on Packaging and Integration of Electronic and Photonic Microsystems. American Society of Mechanical Engineers Digital Collection, 2019.
2. Radmard, Vahideh, Yaser Hadad, Arad Azizi, Srikanth Rangarajan, C. Hiep Hoang, Charles Arvin, Kamal Sikka, Scott N. Schiffres, and Bahgat Sammakia. "Direct Micro-Pin Jet Impingement Cooling for High Heat

Flux Applications." In *2020 36th Semiconductor Thermal Measurement, Modeling & Management Symposium (SEMI-THERM)*, pp. 1-9. IEEE, 2020.

3. Hoang, Cong Hiep, Sadegh Khalili, Bharath Ramakrisnan, Srikanth Rangarajan, Yaser Hadad, Vahideh Radmard, Kamal Sikka, Scott Schiffres, and Bahgat Sammakia. "An Experimental Apparatus for Two-phase Cooling of High Heat Flux Application using an Impinging Cold Plate and Dielectric Coolant." In *2020 36th Semiconductor Thermal Measurement, Modeling & Management Symposium (SEMI-THERM)*, pp. 32-38. IEEE, 2020.
- Refai-Ahmed, Gamal, Brian Philofsky, Vadim Gektin, Bahgat Sammakia, Hoa Do, and Srikanth Rangarajan. "Best Engineering Practices to Establish Cooling Limit for 375W Add-in PCI-e Center Accelerator Card with Active Optical." In *2019 IEEE 21st Electronics Packaging Technology Conference (EPTC)*, pp. 341-348. IEEE, 2019.
4. Ayushman Singh, Srikanth Rangarajan, Leila Choobineh, Bahgat Sammakia "Effective Thermal conductivity of phase change material-based composites for high heat flux electronic cooling" In ASME 2020 International Technical Conference and Exhibition on Packaging and Integration of Electronic and Photonic Microsystems. American Society of Mechanical Engineers Digital Collection, 2020.

Courses taught

1. Optimization of thermal systems, Department of mechanical engineering, Fall 2019, (Student Rating : **3.75/4**)
2. Introduction to basics of optimization, Spring 2019
3. Modelling and optimization of cold plates with multi chip modules, Spring 2020
4. Modelling of phase change material based heats sink, Spring 2020
5. Artificial Neural Network coding in Matlab, Fall 2020 (Ongoing)
6. Cooling of portable electronics using PCMs embedded on to the chip, Fall 2020 (Ongoing)

Students mentored

1. Cong Hiep Hoang
2. Vahideh Radamard
3. Ayushman Singh
4. Najmeh fallahtafti
5. Ghazal Mohsenian

Book chapter

- Rangarajan s, Schiffres S, Sammakia Bahgat, "Scaling limits, challenges, opportunities in embedded cooling", Encyclopedia of Thermal Packaging: Thermal Packaging Tools/Ed.-in-chief Avram Bar-Cohen. Energy Optimization and Thermal Management of Data Centers. World Scientific. Accepted