Benjamin Kubwimana

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Education

Georgia Institute of Technology, Atlanta GA

Master of Science in Electrical & Computer Engineering, *Jan 2023 - Present*

Concentration: Hardware & Software Co-design

Key areas: Novel computer architectures, Optimization and algorithms, VLSI Systems Design

Florida Institute of Technology, Melbourne FL

Master of Science in Mechanical Engineering, *Dec 2021*

Concentration: Machine Learning

Thesis: A Machine Learning-Based Approach to Predict and Optimize the Performance of Zero Energy Buildings (ZEB): A Case Study for Florida

Advisor: Dr. Najafi Hamidreza

Bachelor of Science in Mechanical Engineering, *May 2020*

Minor: Computer Science

Skills

- ***Languages*****:** C++, Cuda, Python, JavaScript, MATLAB,
- ***Machine Learning****:* Regression NN, CNN, RNN-LSTM, Nvidia Modulus (PINN), Bayesian & Genetic optimization, Bayesian networks, TensorFlow
- ***Libraries, APIs & tools****:* OpenMP, OpenMPI, OpenGL, TCP Sockets, pgmpy, Nvidia Nsight Systems & compute, Docker, git, MySQL, SQLite, MongoDB
- ***Operating Systems****:* Linux, Windows, macOS, OpenBMC
- ***Simulation****: Gem5, 3D-ICE,* Cadence Celsius & PowerDC, COMSOL, Ansys Fluent
- ***CAD & Modelling***: Synopsys HSPICE Design tools, SolidWorks, Creo, Icepack,

Professional Experiences

NVIDIA Corp. Santa Clara CA

Hardware Automation Engineer *Dec 2022–Present*

- Building software systems to automate hardware performance benchmarking and data collection, and designing a SQL database for efficient data management, power, and thermal analytics
- Building HPL and CuBLAS-based GPU & SOC workloads to use in power stress tests during system performance characterization
- Developing PINN-based surrogate thermal models and creating system control tools with RNN-LSTM models using TensorFlow
- Leading research projects to introduce novel fan control algorithms for optimizing energy efficiency in air-cooled server systems
- Building Power Management Processor Firmware for fan control, thermal control policies and performance monitoring
- Micro-controller & BMC programming and utilization in server system performance monitoring, including object detection
- Applying physics & thermodynamics principles to design and optimize the performance of Tegra SOC, B100 GPUs, Network cards, and NVIDIA server systems
- Leading research projects to introduce novel cooling and packaging solutions for high-power GPUs
- Performing power and thermal analysis using Cadence solvers, and leading product performance validation and characterization with cross-functional teams

Georgia Institute of Technology, Atlanta, GA.

Graduate student *Jan 2023– Present*

- Conducting performance evaluations of advanced parallel computer architectures using opensource benchmark traces and gem5
- Building custom simulators for multi-level cache systems with DRAM main memory, evaluated on a multi-core system
- Using Synopsis custom compiler tools to successfully implement a high-performance Content addressable memory (CAM) on a 3nm technology, achieving an optimized design for energy-delay and area product
- Developed an inverse modeling algorithm to estimate heat flux in 3D domains using intra-media temperature sensors, applied to a generic ASIC with 10 engines and 4 thermal sensors per engine

Meta Platforms Inc. Sunnyvale CA

Hardware Engineer *Jan 2022– Dec 2022*

- Led thermal simulation studies, evaluating AR & VR hardware performance in varying workloads, solar and wind conditions using COMSOL thermal solvers,
- Created software-automated hardware validation stations to improve product characterization efficiency
- Designed pre-silicon test vehicles for AR/VR hardware to streamline fast and innovative hardware designs
- Lead thermal experimental studies including training and supporting test engineers
- Processed, analyzed, and presented experimental results, driving continuous improvement
- Participated in hardware bring-up, debugging, and troubleshooting investigations

Twitter Inc. Atlanta GA

Hardware Engineering Intern: *May 2021–Sept 2021*

- Conducted research on datacenter infrastructure, developing data-driven solutions that improved energy efficiency by analyzing PUE and environmental metrics
- Optimized cooling units' operations through a control system algorithm study, enhancing energy efficiency and increasing reliability during peak traffic periods
- Redesigned network server rack manifolds to maximize intake airflow, contributing to better thermal management
- Assisted in commissioning new data center halls, ensuring seamless integration into the global network

Sun Nuclear Corporation, Melbourne FL

Hardware Development Engineering Intern *May 2019–Aug 2019*

- Developed motion control circuit boards for radiation therapy devices, contributing to advancements in patient treatment technologies
- Designed and fabricated prototype cable components for a 3D radiation scanner, enhancing device performance and reliability
- Collaborated with the software department to upgrade radon detector programs, improving detection accuracy

Florida Institute of Technology, Melbourne, FL.

Graduate Research Assistant- Machine Learning for BEM *Aug 2020– Dec 2021*

- Conducted research on building energy modeling (BEM) for net-zero energy buildings, advancing sustainable design practices
- Developed a machine learning tool for a virtual building testbed to evaluate the impact of various energy efficiency measures on building performance; project funded by the Florida Department of Agriculture and Consumer Services
- Created a web-based course module featuring multiple teaching tools on sustainable building design, construction, and operation, enhancing educational resources in the field

Teaching & Research *Aug 2020 – Dec 2021*

Graduate Teaching Assistant - Heat Transfer Lab:

- Guided senior-level engineering students in advanced heat transfer lab experiments
- Mentored students in performing thermal analysis and product development

Friends of Handicap in Rwanda

Development Lead: Volunteer *Jan 2010–Present*

- Building a community for disabled children in Rwanda, providing education, healthcare, and sponsorship programs
- Organizing global fundraising events and managing IT systems and websites

Awards and Honors

- NSF conference Award—ICIPE 2024 Brazil
- Florida Tech Distinguished Scholar Award, 2021
- Florida Tech Outstanding Student of the Year academic award, 2021
- Florida Tech Outstanding Student of the Year academic award, 2020
- Phi Eta Sigma—Freshmen Honors Society, 2016
- International Baccalaureate diploma, 2016
- Model United Nations Conference Participant, 2015
- President of Student Body at Green Hills Academy, 2015

Leadership and Community Services

- Member of the Association for Computing Machinery (ACM)
- IEEE Member
- Member of the National Society of Black Engineers (NSBE)
- Secretary of the ASHRAE Student Branch at Florida Institute of Technology
- Assistant Youth Minister at Holy Trinity Church to lead and guide the teenage youth
- Music band member

Publications & Conference papers

- Kubwimana Benjamin, Qijing Huang, "Energy and Performance Analysis of Quantized Vision-Language Models on NVIDIA AGX Orin SoC" *in preparation*.

- Seyednezhad Mohadeseh, Hamidreza Najafi, and Kubwimana Benjamin. 2021. "Numerical and Experimental Investigation of a Thermoelectric-Based Radiant Ceiling Panel with Phase Change Material for Building Cooling Applications" Sustainability 13, no. 21: 11936.

- Kubwimana Benjamin, Najafi H. A Novel Approach for Optimizing Building Energy Models Using Machine Learning Algorithms. Energies. 2023; 16(3):1033. https://doi.org/10.3390/en16031033

- Kubwimana Benjamin, Seyednezhad M, Najafi H. Thermoelectric-Based Radiant Cooling Systems: An Experimental and Numerical Investigation of Thermal Comfort. Energies. 2023; 16(19):6981. https://doi.org/10.3390/en16196981

- Kubwimana Benjamin, Hamidreza Najafi. "Physics Informed Neural Networks for Solving Inverse Heat Conduction Problems in Electronic Packages. ICIPE 2024 The 11th International Conference on Inverse Problems in Engineering. *Conference Presentation*

- Moataz Alghamdi, Kubwimana Benjamin, Hamidreza Najafi. "An Assessment of the Impact of Meteorological Parameters on the Performance of Building Energy Models" *Submitted for publication*