

JUWAN HA

College of Design, North Carolina State University, Raleigh, NC, USA

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Education

North Carolina State University

Raleigh, NC, USA

Ph.D. in Design (Design for Energy and Sustainability)

Aug. 2022 – Present

- Advisor: Prof. Soolyeon Cho

Gyeongsang National University

Jinju, South Korea

M.S in Architectural Engineering

Aug. 2017 – Aug. 2019

- Advisor: Prof. Young-hak Song
- Thesis: A Study on Circulation Pump Configuration and Cooling Tower Control for Improving the Efficiency of Cooling Source System in Buildings **“Outstanding Master's Thesis Award (AIK)”**

Gyeongsang National University

Jinju, South Korea

B.S. in Architectural Engineering

Mar. 2011 – Aug. 2017

- Thesis: A Study on the Quantitative Understanding of Cost-saving Effects of Thermal Storage Operations
- Completion of Accreditation Board for Engineering Education of Korea (ABEEK)

Interests and Skills

Interests

- Energy efficiency improvement of Building HVAC&R systems.
- Building HVAC&R system control for robustness and stability.
- Coordinated or Cooperative energy management from building level up to urban level.

Modelling Model-based (Data-driven, Simulation), Model-free.

Control Deep Reinforcement Learning (DRL), Multi-agent Reinforcement Learning (MARL), Model Predictive control (MPC), Robust control

Etc. Smart Buildings, Zero Energy Buildings (ZEB), Retrofit, District Cooling Plant, Data Center, Fault Detection and Diagnosis (FDD), Convex Optimization, Meta-RL.

Skills

Programming Language Python (PyTorch, Gym, CVXPY, SALib, Eppy), MATLAB (Simulink).

Software EnergyPlus, DesignBuilder, JEPlus, BCVTB, FlowMaster.

Research Experience

Development of EMS with Optimal Control Algorithm for Energy Efficiency Improvement in Commercial Building Using AI and Digital Twin Technology (MOTIE of Korea, No.20014154)

Graduate Research Assistant

BET Lab., NCSU., Raleigh, NC, USA.

Aug. 2022 – Dec. 2024

A Development of One-day Build-up Modular Airborne Infection Isolation Ward based on Free-plan (MOHW of Korea, No. HG22C0044)

Graduate Research Assistant

BEL Lab., Gyeongsang National Univ., Jinju, Korea.

Apr. 2022 – Aug. 2022

- Mechanical, Electrical, and Plumbing (MEP) system development of Modular Negative Pressure Isolation rooms (NPIR)

Green remodeling(retrofit) regional hub platform project. - Gyeongsang Province- (MOLIT of Korea)

Graduate Research Assistant

BEL Lab., Gyeongsang National Univ., Jinju, Korea.

Oct. 2020 – Aug. 2022

- Finding ways to improve the aging of public and medical facilities mainly used by the socially disadvantaged and to improve indoor air quality and energy performance
- Promotion of regional industrial ecosystem creation and capacity strengthening of public building green remodeling project, which is one of the core projects of the Korean New Deal

A study on primary system retrofit methods for high energy performance. (NRF of Korea, No. 2017R1A2B2006424)

Graduate Research Assistant

BEL Lab., Gyeongsang National Univ., Jinju, Korea.

Mar. 2020 – Feb. 2022

- Development of a method to efficiency improvement of central chilled water system
- Energy cut-off evaluation with low liquid to gas ratio operation of cooling tower
- Development control algorithm of cooling tower for low-approach temperature on Python EMS
- Verification of low-temperature condenser water and operation time in HVAC&R system

Development of THI chart for each type of livestock and poultry and THI internal cage prediction model (RDA of Korea, No. PJ013446)

Graduate Research Assistant

BEL Lab., Gyeongsang National Univ., Jinju, Korea.

Jan. 2018 – Dec. 2019

- Development of the notification system for layer chicken
- CFD simulation analysis on windowless laying hen houses which employing a cross or tunnel

-type ventilation system

- Verification of thermal environment and development THI Index prediction model of laying hen house
- Measurement and Verification (M&V) of actual laying hen house

A study on economic analysis of altitude tracking PV systems (Gyeongsang National Univ., UNIC-Lab program)

Graduate Research Assistant

BEL Lab., Gyeongsang National Univ., Jinju, Korea.

Jul. 2017 – Nov. 2017

- Technology proposal of PV systems according to the altitude tracking of the sun
- Energy savings and economic analysis of altitude tracking PV systems

Publications

Journals

- J12** **J. W. Ha**, Y. J. Kim, Y. H. Song “Energy Saving Evaluation with Low Liquid to Gas Ratio Operation in HVAC&R system”, *Energies* (I.F. 3.252), 2022, 15, 7327.
- J11** Y. J. Kim, **J. W. Ha**, Y. H. Song “Energy Efficiency Analysis on Free Cooling Operation Mode with Water-side Economizer System in Data Center”, *Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS)*, Vol. 16, No. 1, pp. 1-13, Feb. 2022.
- J10** **J. W. Ha**, Y. J. Kim, H. Y. Kim, Y. H. Song “Development of Control Algorithm for Cooling Tower Low-Approach Temperature”, *Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS)*, Vol. 15, No. 5, pp.431-442, Oct. 2021.
- J9** S. C. Park, **J. W. Ha**, K. S. Park, Y. H. Song “Sensitivity Analysis and Bayesian MCMC based on Artificial Neural Network Surrogate Model for Input Variable Uncertainty Calibration”, *Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS)*, Vol. 15, No. 4, pp.326-337, Aug. 2021. **“Annual Best Paper”**
- J8** Y. J. Kim, **J. W. Ha**, K. S. Park, Y. H. Song “A Study on the Energy Reduction Measures of Data Centers through Chilled Water Temperature Control and Water-side Economizer”, *Energies* (I.F. 3.004), 2021, 14(12), 3575.
- J7** Y. J. Kim, **J. W. Ha**, K. S. Park, K.H. Lee, Y. H. Song “Energy Evaluation of Data Center with Low Cooling Water Temperature and Free Cooling”, *Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS)*, Vol. 14, No. 5, pp.427-438, Oct. 2020. **“Annual Best Paper”**
- J6** **J. W. Ha**, Y. J. Kim, H. Y. Kim, Y. H. Song “Verification of Low-temperature Condenser Water and Operation Time considering Climate Zones”, *Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS)*, Vol. 14, No. 3, pp.298-309, Jun. 2020.
- J5** **J. W. Ha**, H. H. Chang, K. J. Cha, Y. H. Song “Verification of Thermal Environment and

- THI Prediction Equation of Hen House by Field Measurement and Model-based Simulation”, Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Vol. 14, No. 2, pp.208-219, Apr. 2020.
- J4** **J. W. Ha**, S. Y. Cho, H. Y. Kim, Y. H. Song, “Annual Energy Consumption Cut-off with Cooling System Design Parameter Changes in Large Office Buildings”, *Energies* (I.F. 2.707), 2020, 13(8), 2034.
- J3** **J. W. Ha**, K. S. Park, H. Y. Kim, Y. H. Song “A Study on Annual Cooling Energy Consumption Cut-off with Cooling Tower Control Change”, Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Vol.13, No.6, pp.503-514, Dec. 2019.
- J2** S. C. Park, **J. W. Ha**, H. Y. Kim, Y. H. Song, “An Operation Status of Library Building using BEMS Data -Energy Performance Evaluation on Initial Stage of Completion-”, Journal of KIAEBS, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Vol. 12, No. 6, pp.669-679, Dec. 2018.
- J1** **J. W. Ha**, K. S. Park, H. Y. Kim, Y. H. Song “A Study of Zero Energy Building Verification with Measuring and Model-based Simulation in Exhibition Building”, ARCHITECTURAL RESEARCH, Architectural Institute of Korea (AIK), Vol. 20, No. 3, pp.93-102, Sep. 2018. **“Annual Best Paper”**

Conferences

- C7** **J. W. Ha**, Y. J. Kim, Y. H. Song “A Study on the Verification Approach Temperature of Cooling Tower according to the Change L/G Ratio”, Autumn Conference for Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Chungju, Republic of Korea, Nov. 2020.
- C6** Y. J. Kim, **J. W. Ha**, Y. H. Song “A Study on the Cooling Performance of Water-side Economizer System on The Chilled Water Return-side Applying Partial Operation”, Autumn Conference for Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Chungju, Republic of Korea, Nov. 2020. **“Best Paper Award of Fall Conference”**
- C5** Y. J. Kim, **J. W. Ha**, Y. H. Song “A Study on the Cooling Energy Consumption Cut-off in the Intermediate Season of the Data Center” Summer Conference for The Society of Air-conditioning and Refrigerating Engineers of Korea (SAREK), Pyeongchang, Republic of Korea, Jun. 2020.
- C4** S. C. Park, **J. W. Ha**, Y. J. Kim, Y. H. Song “A Study on the Thermal Storage Loss Rate for the Geothermal Storage System”, Autumn Annual Conference of Architectural Institute of Korea (AIK), Daejeon, Republic of Korea, Oct. 2019.
- C3** **J. W. Ha**, Y. H. Song “Comparison Analysis of Temperature and Humidity Index (THI) according to Ventilation Type of laying house”, Autumn Conference for Busan-Ulsan-Gyeongnam Chapter of Architectural Institute of Korea (AIK), Jinju, Republic of Korea, Nov. 2018.
- C2** **J. W. Ha**, Y. H. Song “THI Index within Laying house according to the Predicted Outside Temperature”, Autumn Conference for Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Incheon, Republic of Korea, Nov. 2018.
- C1** **J. W. Ha**, Y. H. Song “A Study on Economic Analysis for Adapting Ice Thermal Storage System to Retrofit of Heat Source System”, Autumn Conference for Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS), Seoul, Republic of Korea, Nov. 2017.

Honors and Awards

Awards

- 2022 Annual Best Paper Award, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS).
- 2021 Annual Best Paper Award, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS).
- 2020 Best Paper Award of Fall Conference, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS).
- 2020 GNU Young Pioneer Researcher Award, Gyeongsang National University.
- 2020 Outstanding Master's Thesis Award, Architectural Institute of Korea (AIK).
- 2019 GNU Young Pioneer Researcher Award, Gyeongsang National University.
- 2019 Annual Best Paper Award, Architectural Institute of Korea (AIK).
- 2018 Excellence Award, Waryong Mountain sustainable design competition (\$1,000), Samcheonpo Headquarters of Korean South-East power Co. (KOEN).
- 2017 Bronze Prize, Portfolio contest, Accreditation Board for Engineering Education of Korea (ABEEK)
- 2017 Excellence Award, LINC-GPP, Gyeongsang National University.
- 2017 Best Award, Portfolio contest, Pusan National University (South Gyeongsang province chapter)
- 2017 Golden Prize, Portfolio contest (\$300), Gyeongsang National University.

Scholarships

- 2023 **IIBEC Travel Fellowship**
 - 40th IIBEC International Convention and Trade show (Mar. 3-6)
 - Venue: Houston, TX, USA
- 2022-2023 **University Graduate Fellowships, North Carolina State University**
 - This fellowship is awarded to outstanding new doctoral students
- Spring 2017 **Pioneer C Scholarships (\$1,220), Gyeongsang National University**
 - This scholarship is awarded to students with outstanding academic achievement
- Fall 2016 **Pioneer A Scholarship (\$1,760), Gyeongsang National University**
 - This scholarship is awarded to a student with the highest academic achievement in the semester
- Fall 2016 **Global Pioneer Program Scholarships (\$1,800), Gyeongsang National University**
 - This scholarship supports students for overseas field tours relevant to green building, building retrofit trip to visit Sheffield Univ. (UK), KU Leuven Univ. (Prof. Staf Roels, Belgium), Physibel (Prof. Piet Standaert, Belgium), Scheldebouw of Permasteelisa Group (Group R&D Manager. Henk De Bleecker, Belgium), Green Buildings (UK, Netherlands, Germany), etc.

- Spring 2016 **Internationalization B Scholarship (\$700), Gyeongsang National University**
- Spring 2016 **Gyeongsang Scholarships (\$2,160), Gyeongsang National University**
- This scholarship is awarded to a student in first place in the Department of Architectural Engineering
- 2016 **Seonghwa Industrial Corporate Scholarships (\$2,000)**
- Fall 2015 **Pioneer C Scholarships (\$1,000), Gyeongsang National University**
- This scholarship is awarded to students with outstanding academic achievement

Assistantships

- 2022-Present Research Assistant, North Carolina State Univ.
- 2021 Research Assistant, Gyeongsang National Univ.
- 2020 Research Assistant, Gyeongsang National Univ.
- Spring, 2019 Teaching Assistant, Gyeongsang National Univ.
- 2019 Research Assistant, Gyeongsang National Univ.
- 2018 Research Assistant, Gyeongsang National Univ.

Patents and Certificates

Patents

- P3** “Operation Control System and Method for High Difference and Low Condensing Temperature Water on Cooling Towers”, Patent application:10-2021-0048529. Patent registration: 10-2325379. Republic of Korea.
- P2** “The Notification System for Layer chicken”, Patent application: 10-2019-0173894. Patent registration: 10-2363864. Republic of Korea
- P1** “Method for Predicting a Temperature-Humidity Index in a Windowless Laying Hen Houses Which Employing a Cross-Type or Tunnel Type Ventilation System”, Patent application: 10-2019-0064580. Patent registration: 10-2308895. Republic of Korea.

Certificates

- CERT3** “Certificate of Engineer Building Facilities”, The Human Resources Development Service of Korea, Republic of Korea, 2018.
- CERT2** “Building Energy Analysis Skill UP Training (Based on ISO 13790, DIN V18599)”, Institute for Passive Zero Energy Building (IPAZEB), 2017.
- CERT1** “Certificate of Engineer Architecture”, The Human Resources Development Service of Korea, Republic of Korea, 2017.

Professional Experience

- Graduate research assistant BET Lab., NC STATE Univ., Raleigh, NC, USA.
Aug. 2022 – Present
- Graduate research assistant BEL Lab., Gyeongsang National Univ., Jinju, South Korea.
Sep. 2017 – Aug. 2022

Administrative assistant	Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS) – Yeong Nam (YN) chapter <i>Jul. 2020 – Mar. 2021</i>
Teaching assistant	Gyeongsang National Univ., Jinju, South Korea <i>Spring, 2019</i>
Administrative assistant	Architectural Institute of Korea (AIK) Busan·Gyeongnam chapter <i>Apr. 2018 – Mar. 2019</i>
Construction field engineer intern	HYUNDAI E&C Co., Singapore
Singapore Marina One Site: LEED Platinum, BCA Green Mark Platinum	<i>Jan. 2017 – Feb. 2017</i>
Tactical aircraft maintenance crew	Republic of Korea Air Force., Sacheon, South Korea <i>Sep. 2012 – Sep. 2014</i>

Other Activities

Seminar

2023-Present ACM SIGEnergy Graduate Student Seminar.

Workshops

2017 The 2nd Joint Workshop of Architectural Engineering: Gyeongsang National Univ. (South Korea) & Kyushu Univ. (Japan)

Professional Affiliations

2023-Present Student Member, Association for Computing Machinery (ACM) SIGEnergy
 2022-Present Student Member, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
 2018-Present Member, International Building Performance Simulation Association (IBPSA)
 2018-Present Member, Architectural Institute of Korea (AIK)
 2017-Present Member, Korean Institute of Architectural Sustainable Environment and Building Systems (KIAEBS)