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Edwin Lee

Summary

Engineer and software developer with deep experience in simulation, numerical modeling, and scientific tool development. Skilled in building robust, open-source tools in Python and C++ for domains like ground heat exchanger design, energy systems, and embedded monitoring. Equally comfortable architecting large-scale backend systems, designing efficient data models, or writing low-level hardware interface code. Known for pragmatic solutions, thoughtful software structure, and effective collaboration across disciplines.

Education

2013 **Doctor of Philosophy, Mechanical Engineering**, *Oklahoma State University*, GPA: 4.0
Dissertation: A Generalized Pipe Heat Transfer Model for Whole Building Simulation Applications

2008 **Master of Science, Mechanical Engineering**, *Oklahoma State University*, GPA: 4.0
Thesis: Development, Implementation, and Verification of a Buried Pipe Model in EnergyPlus

2006 **Bachelor of Science, Mechanical Engineering**, *Oklahoma State University*, GPA: 3.52
Focus: Building science, fluid flow, heat transfer, and HVAC system design and simulation

Experience

May 2013 to Present **Research Engineer**, *National Renewable Energy Laboratory*, Golden, CO & Remote

- Contributed to the Technology Performance Exchange (TPEx) via Data Entry Form development, dataset processing, and development of the logic and scripts to convert TPEx datasets into components on the Building Component Library
- Began leading technical development of EnergyPlus, overseeing the technical changes accompanying the translation from FORTRAN to C++, and StarTeam to GitHub

June 2006 to May 2013 **Graduate Research Assistant**, *Oklahoma State University*, Stillwater, OK

- A complete re-write of the EnergyPlus central plant simulation, including solution algorithms, pump model re-work, and updating component model design
- Developed a generalized horizontal ground heat exchanger model that includes interaction with a basement zone, specifically for use with foundation heat exchangers
- Performed experimental measurement and modeling of transport delay phenomena in piping systems
- Worked closely with the Center for the Built Environment at University of California, Berkeley, providing simulation support for Underfloor Air Distribution System research with EnergyPlus

Fall 2007 and Summer 2009 **Engineering Consultant**, *Oak Ridge National Laboratory*, Oak Ridge, TN

- Utilized EnergyPlus to investigate wall constructions for residential applications
- Established workflows in VBA, Fortran, and VB.Net to execute parametric runs
- Constructions included frame walls, solid wood walls, and phase change materials

Summer 2005 **Engineering Intern**, *Specific Systems*, Tulsa, OK

- Introduced to design and manufacturing of modular HVAC equipment
- Designed and fabricated parts
- Performed various mechanical and structural analysis on designs
- Aided in the construction of a thermal test chamber

Skills

Platforms	Highly experienced developing on Linux, Windows, and Mac
Scripting	Python, Ruby, Batch, Bash, VBA
Compiling	Python, C++, C, Fortran, VB.Net, Modelica
Toolchains	Experienced with GCC, Clang, and MSVC builds, along with CMake and Ninja
Development	Familiar with all major build systems and IDEs
Web	HTML, CSS, and Javascript, Django client and server code, APIs and databases
GUIs	Python frameworks including tkinter, pygobject, PyQT, and Wx; SFML and QT on C++
Tools	Git, Docker, GitHub (Actions, Projects, Review), Virtual Machines
Office	Expert with Word, Excel, Powerpoint, as well as FOSS and Google alternatives
Writing	Highly experienced with the LaTeX ecosystem, including BibTex and auxiliary tools
Auxiliary	Experienced with EES, MathCAD, R, Fluent, AutoCAD, Octave/Matlab

Publications, Reports, and Proceedings

Eric Bonnema, Amy Allen, Edwin Lee, Matt Mitchell, and Ryan Meyer. Flexible integration of diverse hvac technologies in energyplus via python-enabled workflows. Technical report, National Renewable Energy Lab.(NREL), Golden, CO (United States), 2025.

Liping Wang, Lichen Wu, Leslie Keith Norford, Amir A Aliabadi, and Edwin Lee. The interactive indoor-outdoor building energy modeling for enhancing the predictions of urban microclimates and building energy demands. *Building and Environment*, 248:111059, 2024.

Ryan Davies, Matt Mitchell, and Edwin Lee. A high-speed portable ground heat exchanger model for use in various energy simulation software. *Macalester Journal of Physics and Astronomy*, 11(1):4, 2023.

M Piette, B Hooper, T Hong, D Macumber, SH Lee, Y Chen, N Long, E Lee, IR Dela Cruz, MA Piette, et al. The bayren integrated commercial retrofits (bricr) project: An introduction and preliminary results. Technical report, Lawrence Berkeley National Lab.(LBNL), Berkeley, CA (United States), 2018.

Anthony D Fontanini, Jose L Castro Aguilar, Matt S Mitchell, Jan Kosny, Noel Merket, Jason W DeGraw, and Edwin Lee. Predicting the performance of radiant technologies in attics: Reducing the discrepancies between attic specific and whole-building energy models. *Energy and Buildings*, 169:69–83, 2018.

Daniel Studer, John H Barkyoumb, Edwin Lee, Brian L Ball, Stephen Frank, Eugene Holland, Jeffrey Green, William Robinson, Jeff Brown, and Jennifer Golda. Leveraging shore-side, building energy simulation tools for use in the shipboard environment. *Naval Engineers Journal*, 130(2):129–140, 2018.

David Goldwasser, Daniel Macumber, Andrew Parker, Edwin Lee, Rob Guglielmetti, and Larry Brackney. The life cycle of an openstudio measure: Development, testing, distribution, and application. In *ASHRAE & IBPSA-USA SimBuild Conference 2016*, volume 7, pages 222–229. ASHRAE/IBPSA-USA, 2016.

Paul Raftery, Edwin Lee, Tom Webster, Tyler Hoyt, and Fred Bauman. Effects of furniture and contents on peak cooling load. *Energy and Buildings*, 85:445–457, 2014.

Daniel Studer, Katherine Fleming, Edwin Lee, and William Livingood. Enabling detailed energy analyses via the technology performance exchange. Technical report, National Renewable Energy Lab.(NREL), Golden, CO (United States), 2014.

Edwin Scott Lee. *An improved hydronic loop system solution algorithm with a zone-coupled horizontal ground heat exchanger model for whole building energy simulation*. PhD thesis, Oklahoma State University, 2013.

Edwin S Lee, Daniel E Fisher, and Jeffrey D Spitler. Efficient horizontal ground heat exchanger simulation with zone heat balance integration. *HVAC&R Research*, 19(3):307–323, 2013.

Zeyu Xiong, Edwin S Lee, and Daniel E Fisher. Development of a horizontal slinky ground heat exchanger model. *ASHRAE transactions*, 119(2), 2013.

Ramprasad Chandrasekharan, Edwin S Lee, Daniel E Fisher, and Pratik S Deoka. An enhanced simulation model for building envelopes with phase change materials. *ASHRAE Transactions*, 119(2), 2013.

James R Cullin, Edwin Lee, et al. Preliminary investigation of the effect of horizontal piping on the performance of a vertical ground heat exchanger system. *ASHRAE Transactions*, 119:302, 2013.

James R Cullin, Lu Xing, Edwin Lee, Jeffrey D Spitler, and Daniel E Fisher. Feasibility of foundation heat exchangers for residential ground source heat pump systems in the united states. *ASHRAE Transactions*, 118(1), 2012.

Tom Webster, Tyler Hoyt, Edwin Lee, Allen Daly, Fred Bauman, Stefano Schiavon, Kwang Ho Lee, Wilmer Pasut, and Dan Fisher. Influence of design and operating conditions on underfloor air distribution (ufad) system performance. 2012.

Lixing Gu, Don Shirey, Richard Raustad, Bereket Nigusse, Chandan Sharma, Linda Lawrie, Rich Strand, Curt Pedersen, Dan Fisher, Edwin Lee, et al. Advancement of doe's energyplus building energy simulation program. Technical report, University Of Central Florida, 2011.

Jan Kosny, David Yarbrough, Phil Childs, Som Shrestha, William Miller, Jerry Atchley, Marcus Bianchi, John Smith, Tom Fellinger, Elizabeth Kossecka, et al. Theoretical and experimental thermal performance analysis of building shell components containing blown fiberglass insulation enhanced with phase-change material (pcm). In *11th International Conference on Thermal Performance of the Exterior Envelopes of Whole Buildings, Buildings XI*, 2010.

JD Spitler, J Cullin, M Bernier, M Kummert, P Cui, X Liu, E Lee, and D Fisher. Preliminary intermodel comparison of ground heat exchanger simulation models. In *Proceedings of 11th International Conference on Thermal Energy Storage*, volume 6, pages 14–17. Stockholm: Effstock, 2009.

Jan Kośny, David W Yarbrough, William A Miller, Kenneth E Wilkes, and Edwin S Lee. Analysis of the dynamic thermal performance of fiberous insulations containing phase change materials. In *11th International Conference on Thermal Energy Storage, Effstock*, 2009.

Lorenzo Cremaschi and Edwin Lee. Design and heat transfer analysis of a new psychrometric environmental (ihamber testing. *Transactions*, 114(2):619–631, 2008.

Edwin Lee. Development, verification, and implementation of a horizontal buried pipe ground heat transfer model in energyplus. Master's thesis, Oklahoma State University, 2008.

ASHRAE Membership & Activities

2005-2013	Student Member
2007-2012	Student Branch President
2013-Present	Active Member in TC 4.7 and TC 9.13
2019-2023	TC 4.7 Simulation and Component Modeling Subcommittee Chair

Honors & Awards

Phi Kappa Phi Honor Society | Superior Scholarship

A. B. Still Memorial Scholarship | Performance in Mechanical Engineering

Two-time ASHRAE Memorial Scholarship | Performance and Research Interests

Conoco-Phillips Memorial Scholarship | Performance in Graduate Studies

Projects

GHEDesigner — Open-source Python tool for GHE layout and sizing

Freezer Monitor IoT — Raspberry Pi-based wireless temperature monitoring

EnergyPlus Focus — A graphical tool to improve work-flow during development of EnergyPlus

- Ability to modify reporting frequency/contents to any idf without opening the file
- Test suite tool to provide specific testing of particular file types and configurations
- Parametric tool using the EPMacro preprocessor, allows a generic number of parameters
- Direct access to calculate a mathematical difference summary of two EnergyPlus output files
- An IDF analyzer that compares directories of IDFs
- Ability to run an EnergyPlus simulation on any input file with a single click using a compiled EnergyPlus library

Plant Parameter Estimation — A tool to regress manufacturer's data into EnergyPlus inputs

- Ability to paste in tabulated and correction factor data
- Creates a graphical report showing the resulting parameter quality
- Modular code allows for easy extension for new model types
- Multithreaded code allows the graphical interface to run while background operations perform the curve fit or parameter estimation

Buried Pipe Heat Transfer Tool — A graphical tool for performing buried pipe simulations

- Formal XML input/output program structure
- Utilizes the same model that is implemented in EnergyPlus for buried pipe simulations
- Graphical mesh display and temperature/thermal property distribution

Data Acquisition — A graphical Python application for monitoring data acquisition

- Monitors data acquisition from a serial/USB port RS-232 device
- Records raw data signals, converts to an analog, and processes into physical measurements where applicable
- Running graphs on-screen show each measurement status
- Implemented on a Linux machine, portable to other operating systems

IDD/IDF Library

Multi-language library for accessing/manipulating idd and idf files

- VB.Net based library parses IDD and IDF with extensive error handling
- VB.Net application includes GUI and file comparison tools
- Python cross platform library is lightweight, simple, with minimal error handling
- Python application allows quick processing of well-formed idfs including multiple file comparisons