C O N T A C T I N F O R M A T I O N

Center for Energy & Environmental Resources (CEER)
J.J. Pickle Research Campus, University of Texas at Austin
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RESEARCH INTERESTS

My research primarily focuses on developing cutting-edge modeling and experimental methodologies for addressing challanges with building energy conservation and improving energy efficiency for design, performance and operation of building energy systems. Application domain includes building energy management, thermal comfort, indoor air quality, smart sensing and control systems and grid-interactive district energy systems.

ACADEMIC BACKGROUND

01.2017 – 12.2021 **Ph.D. Civil, Architectural and Environmental Engineering, Building Energy & Environment (BEE) Program, University of Texas at Austin, USA**.
Thesis title: Indoor and Outdoor Radiant Cooling Systems for Buildings.
Advisor: Professor Atila Novoselac.

10.2013 – 01.2016 **M.Sc. Mechanical Engineering, K. N. Toosi University of Technology, Iran**.
Thesis title: The optimized analysis of thermal parameters in building energy consumption using optimization methods and inverse analysis.
Advisor: Professor Cyrus Aghanajafi.

02.2009 – 06.2013 **B.Sc. Mechanical Engineering (Heat & Fluids), I. Azad University, Iran**.
Thesis title: Numerical modeling of HVAC system design in Hospitals.
Advisor: Professor Hamid Rastegari

01.2007 – 07.2008 **A.Sc. Installations-Central Heating & Air Conditioning Technology, Enghelab Eslami Technical & Vocational University, Iran**.

09.2003 – 12.2006 **Diploma. Heating, Ventilation & Air Conditioning Technology, AzadiFelestin Technical and Vocational High School, Iran**.

RESEARCH WORK EXPERIENCE

PhD Research Assistant

Center for Energy & Environmental Resources (CEER),
University of Texas at Austin, TX, USA.

10.2020 – Present
Optimal Co-Design of Integrated Thermal-Electrical Networks and Control Systems for Grid-interactive Efficient District (GED) Energy Systems
Sponcered by U.S. Department of Energy (DOE)
(Valued at ~ $4.16M, Awarded 10/2020, Ongoing)
URL: https://www.colorado.edu/lab/sbs/grid-interactive-efficient-district-energy-system

- Development of smart thermal-electrical networks and control systems for the optimal design of grid-interactive efficient district (GED) combined heat and power (CHP) energy systems, particularly for intermittent renewable energy resources (Solar PV, Wind) and maintain resiliency and autonomy of microgrid.
- Creating a holistic open-source modeling platform for the optimal design and retrofit of GED energy systems using National Renewable Energy Laboratory (NREL)'s URBANopt and Lawrence Berkeley National Laboratory (LBNL)'s Modelica Building library platforms.
- Demonstration of the Optimal Co-Design Model Platforms at two real-world DE/microgrid testbeds at UT Austin and CU Boulder and evaluation of the optimization scheme and energy saving by implementing smart grid-interactive energy systems.
- Leading the CHP modeling using Modelica platform and technical data collecion for UT Austin campus energy plant, including chillers, steam boilers, gas turbies, heat recovery steam generators, solar PV, electric vechiles.

09.2019 – 03.2021
SBIR Phase II: Passive Radiative Composite Material
Sponcered by National Science Foundation (NSF-1831805), in collaboration with PC Krause and Associates, Inc.
(Valued at ~ $798K, Awarded 09/2018, Completed)
URL:https://www.nsf.gov/awardsearch/showAward?AWD_ID=1831805&HistoricalAwards=false

- Application of passive radiative cooling (PRC) composite to create an ultra-cool metal roofing intended to reduce heat transfer into the building, lower the daytime peak load and energy costs associated with the building air conditioning.
- Leading technical design of twin test chambers with interchangable roof assemblies and installations of measurement instrumentations and data acquisition systems at UT roof testing labratory (RTL).
- Planning the development of a comprehensive experimental benchmark for metal roof testing, and leading the campaign for executing a set of full-scale experiments to evaluate thermal performance of PRC-based roofing in comparison with other commercially available metal roofing (30-gauge galvanized steel corrugated panels, FABRAL heavy-gauge galvanized steel and bone white cool roofs), deployed in large-scale application and under realistic environmental conditions.
- Development of new sky radiation models for energy analysis of PRC systems and implementation of PRC surfaces in already-developed state-of-the-art building energy modeling software for different roofing applications (residential, commercial, warehouses, supermarkets and retail stores).

10.2018 – 07.2019
Enhancement in the Cooling Capacity and Control of Hydronic Radiant Systems by Altering Panel Geometry (Sanken panels) & Elevating Indoor Air Movement (Ceiling fan)
Sponcered by Sanken Setsubi Kogyo, in collaboration with Center for Built Environment (CBE) at University of California at Berkeley.
(Valued at ~ $15K, Awarded 11/2018, Completed)
URL:https://cbe.berkeley.edu/centerline/engineering-leader-sanken-to-collaborate-on-radiant-cooling-technologies/

- Advance system control for radiant systems by integrating operative temperature measurement with high precision for achieveing optimal thermal comfort and energy saving in radiantly conditioned spaces.
- Examine the role of convection in enhancing Radiant panel cooling capacity when combined with fan-induced elevated air movement.

- Leading experimental measurements for surafce convection coefficients and development of new convection correlations for rooms with ceiling fan and radiant panels.
- Planning and executing experimental measurements for evaluating the cooling performance of perforated Sanken radiant cooling panels in comparison with conventional flat radiant panels, and developing system cooling capacity curves for sizing Sanken radiant panels.

09.2016 – 01.2019
Experimental Verification of Cooling Load Calculations for Spaces with Non-Uniform Temperature Radiant Surfaces
Sponcered by American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE 1729-RP)
(Valued at ~ $180K, Awarded 07/2016, Completed)

- Leading the effort for development of an experimental benchmark to investigate complex heat transfer of radiant cooling systems and identify fundamentals of cooling load for these systems and determine how the cooling load of radiant systems differs from conventional all-air HVAC systems.
- Explore limitations of conventional all-air convective based methods, such as Heat balance method (HBM) and radiant time series (RTS), in the load calaculation of radiant systems, and extending the current HBM for cooling load calculation of radiant cooling surafces.
- Major contribution in the software development, validation and application of a comprehensive heat transfer and energy simulation platform for cooling load calculation of radiant surfaces in the ASHRAE load calculation toolkit.
- Development of new models for system design procedures and sizing of hydronic radiant cooling panels for being incorporated in the ASHRAE and other relevant building design guidelines used worldwide by HVAC designers and practitioners.

M.Sc. Research Assistant
Center for Energy Excellence (CEE),
K. N. Toosi University of Technology, Tehran, Iran.

09.2013 – 12.2015
Building System Design Parameter Estimation Using Inverse Analysis Technique
Sponcered by Center for Energy Excellence (CEE)

- Development of an energy modeling framework for thermal parameter estimation using inverse analysis to optimize building energy consumption and thermal comfort.
- Extension of inverse energy modeling platform to incorporate optimal thermal system design for HVAC (Radiator and Fan Coil) and solar heating equipment.

10.2012 – 09.2013
Optimal Building Energy Simulation Using Stochastic Optimization Methods

- Applying Genetic & PSO optimzation algorithms in couple with the energy simulation software to achieve energy saving for central HVAC system in residential and commercial buildings for different climates in Iran.

B.Sc. Research Assistant
Islamic Azad University, Tehran, Iran.
08.2011 – 01.2012
Numerical modeling of HVAC system design in Hospitals

- HVAC system engineering design for hospitals using Energy Plus and Carrier software

TECHNICAL EXPRIENCE

01.2019 – 01.2021
UT Roof Testing Laboratory Construction and Development
URL: https://www.caee.utexas.edu/prof/Novoselac/atila_files/Laboratories.html#UTest%20House

- Follow-up on SBIR Phase I effort (NSF-1648007) by PC Krause and Associates Inc. (PCKA), about design, development and optimization of passive radiative composite (PRC) material, prototype fabrication and testing of PRC technology:
  URL: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1648007#3

- In collaboration with PCKA and in response to SBIR Phase II (NSF-1831805) on manufacturing of PRC films and the commercial-scale deployment and testing of PRC-based roofing technology for building energy management.
  URL:https://www.nsf.gov/awardsearch/showAward?AWD_ID=1831805&HistoricalAwards=false

- Design and development of twin test houses with interchangable metal roof assemblies, and equipping with numerous temperature and heat flux sensors for heat transfer analysis of PRC-based roof.

- Replacement and installation of commercially available metal roofing products (30-gauge galvanized steel corrugated panels, FABRAL heavy-gauge galvanized steel and FABRAL bone white cool roofs) on the test houses.

- Installation and the deployment of sophisticated measurement instrumentations, data acquistion systems and diagnostic equipment for comparing thermal performance of the test houses with different roof assemblies.

01.2017 – 10.2018
UT Thermal Façade Lab Development, Installation and Equipment
URL: https://soa.utexas.edu/resources/thermal-lab

- Follow-up to the prior IGERT: Sustainable Grid Integration of Distributed and Renewable Resources Project (NSF-0966298) for design and construction of Thermal Facade Lab (TFL).
  URL: https://www.nsf.gov/awardsearch/showAward?AWD_ID=0966298

- In collaboration with the UT school of Architecture and in response to ASHRAE 1729-RP for the purpose of extensive experimental measurements for updating cooling load calculation methods for radiant cooling panels.

- Design and installation of hydronic-based HVAC system, including facilities to support both air and radiant cooling systems (flat and Sanken panels).

- Design and implementation of different ventilation strategies, including mechanical ventilation by fan Coil and indoor air circulation by ceiling fans.

- Design and deployment of sophisticated automatic control systems for operation of radinat and air systems at the Thermal Façade Lab.

- Design and assembly of air/operative temperature sensors for thermal comfort.

03.2008 – 11.2012
Technical/Practical Work Experience in HVAC Industry, Iran.

- Worked in private sector on design, installation and restoration of various HVAC projects in residential buildings (heating and cooling), commercial buildings (Hospitals, hotels, university, office buildings).

TEACHING EXPRIENCE

01.2017 – 01.2022
Graduate Student, Department of Civil, Architectural and Environmental Engineering, University of Texas at Austin

Teaching Assistant in graduate and senior-undergraduate level courses: Energy Simulation in Building Design, Building Environmental Systems, Building Energy Management Systems, Introduction to Architectural Engineering. This included class discussion sessions, office hours, prepared and graded class projects.

10.2014 – 01.2016
Graduate Student, Department of Mechanical Engineering, K. N. Toosi University of Technology, Iran.

Teaching Assistant for various undergraduate level courses: Fluid Mechanics I, Heat Transfer II, Thermodynamics II, HVAC Design. This included lectures, discussion sessions, office hours, graded class projects and developed laboratory class syllabus.

MENTORSHIP EXPRIENCE

University of Texas at Austin
08.2019 – 03.2020 Justin Guinn (Currently pursuing PhD at UT Austin)

K. N. Toosi University of Technology, Iran
05.2015 – 11.2015 Ali Javadi (Now senior engineer at Ministry of Energy Department, Iran)
10.2014 – 03.2015 Shohreh Tajik (Now research engineer, Sydney, Australia)

PROFESSIONAL EXPRIENCE

- **Reviewer:** International Journal of Thermal Science, Journal of Heat Transfer-Transaction of ASME, Energy and Buildings, Journal of Solar Energy Engineering (ASME): including Wind Energy and Building Energy Conversion.

- **Chair and convener** for session “Application of Solar Heating Systems” at The 2nd Conference on Exhibition on Solar Energy, September 2015, University of Tehran, Tehran, Iran.

- **Co-chair and co-convener** for session “Energy efficient HVAC systems, operation and control” at The 6th International Conference on Heating, Ventilation, Air Conditioning (ICHVAC), Tehran, Iran, 2015.

ACADEMIC HONORS & AWARDS

September 2020
Grant-In-Aid (GIA) Honorarium, ***American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)***
Merit-based Grant-In-Aid (GIA) honorarium for publishing GIA-related research in ASHRAE conference, (Valued at $1.5K).

2017 - 2018
Grant-In-Aid (GIA) Fellowship, ***American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)***
Merit-based Grant-In-Aid (GIA) Fellowship to support ASHRAE-related research, (Valued at $10K).

September 2018
Kolodzey Travel Grant, *Department of Cvil, Architectural & Environmental Enginerering at University of Texas at Austin*
Merit-based award for graduate students for traveling to technical conferences, (Valued at ~ $1K).

August 2016
Preeminent Distinguished Researcher, K. N. Toosi University of Technology.
Merit-based award for the best research M.Sc. student among all Engineering Departments.

2013 - 2015
Government Fellowship for Graduate Studies, Iran

2009
Ranked 1st among 20,000 participants in National B.Sc. Entrance Exam, Iran.

2007
Ranked 2nd among 10,000 participants in National A.Sc. Entrance Exam, Iran.

LIST OF PUBLICATIONS

- **Moftakhari, A.**, Novoselac, A. (2020). Improvement in the Operative Temperature Measurement of Radiant Cooling Panels, *ASHRAE Transactions*, Vol. 126 (2), pp. 419-426.

- **Moftakhari, A.**, Novoselac, A. (2020). Experimental Study on Cooling Loads of Radiant and All-Air Systems, *ASHRAE Virtual Conference*.

- **Moftakhari, A.**, Moftakhari Chaei Ghazvin, A. (2017). Natural Element Method Study of Combined Convective and Radiative Heat Transfer in Irregular shaped Mediums with Radiative Properties, *International Journal of Thermal Science*, Vol. 122, pp. 141-161, (https://doi.org/10.1016/j.ijthermalsci.2017.07.029).

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari Chaei Ghazvin, A. (2017). A Novel Numerical Approach For Convective and Radiative Heat Transfer Analysis of Fluid Flow Problems Within Triangular Cavities Using Natural Element Method, *Journal of Heat Transfer- Transaction of ASME*, Vol. 139(8), 082002, (https://doi.org/10.1115/1.4036057).

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari Chaei Ghazvin, A. (2017). Inverse heat transfer analysis of radiator central heating systems inside residential buildings using sensitivity analysis, *Inverse Problems in Science and Engineering*, Vol. 25, Issue 4, pp. 580-607, (DOI:10.1080/17415977.2016.1178258).

- **Moftakhari, A.**, Torabi, F., Aghanajafi, C. (2016). A novel energy simulation approach for thermal design of buildings equipped with radiative panels using inverse methodology, *Energy and Buildings*, Vol.113, pp.169-181 (DOI:10.1016/j.enbuild.2015.12.007).

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari Chaei Ghazvin, A. (2016). An innovative inverse analysis technique for building cooling design with HVAC systems, *Science and Technology for the Built Environment*, Vol.22, Issue 3, pp. 299-316, (DOI:10.1080/23744731.2016.1132940).

- **Moftakhari, A.**, Aghanajafi, C. (2016). An inverse parameter estimation method for building thermal analysis, *Journal of Solar Energy Engineering (ASME): Including Wind Energy and Building Energy Conversion*, Vol. 138, Issue 2, pp. 021004-021004-11, (DOI: 10.1115/1.4032476).

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari Chaei Ghazvin, A. (2016). Thermal analysis of HVAC and Solar panels using genetic optimization algorithm, *Journal of Mechanical Science and Technology*, Springer Verlag, Vol. 30, No. 3, pp. 1405-1412, (DOI 10.1007/s12206-016-0248-9).

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari Chaei Ghazvin, A. (2015). A Comparative study of HVAC and Radiant systems for heating buildings in different climates of Iran, *Indian Journal of Natural Science (IJONS)*, Vol. 31, pp. 8615-8633.

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari Chaei Ghazvin, A. (2015). The use of solar radiative panels for heating residential buildings in different climates of Iran, *The 2nd Conference on Exhibition on Solar Energy*, University of Tehran, Tehran, Iran.

- **Moftakhari, A.**, Aghanajafi, C. (2015). Inverse design of residential room with radiative panels",*The 7th Conference on efficient, clean and Renewable Energy*, Tehran, Iran (In persian).

- **Moftakhari, A.**, Aghanajafi, C., Moftakhari chaei ghazvin, A. (2015). The use of solar energy to optimize energy consumption pattern in Iran, *The 3rd International symposium on Environmental & Water Resources Engineering*, K. N. Toosi University Of Technology, Tehran, Iran.

- **Moftakhari, A.**, Aghanajafi, C. (2015). Building energy consumption using generic algorithm,*The 1st Conference on Heating, Ventilation, Air Conditioning (HVAC) and Heating & Cooling Installation*, Tehran, Iran (In persian).

- **Moftakhari, A.**, Aghanajafi, C. (2015). Inverse Design of conductivity coefficient in building equipped with solar panels, *The 6th International Conference on Heating, Ventilation, Air Conditioning (ICHVAC)*, Tehran, Iran (In persian).

- **Moftakhari, A.**, Aghanajafi, C. (2015). Thermal Analysis of a residential room equipped with Solar panel using generic algorithm, *The 6th International Conference on Heating, Ventilation, Air Conditioning (ICHVAC),* Tehran, Iran.

- **Moftakhari, A.**, Moftakhari chaei ghazvin, A. (2015). Estimation of Building energy consumption using PSO optimization algorithm,*The 7th Conference on efficient, clean and Renewable Energy*, Tehran, Iran.

PAPERS IN PREPARATION / UNDER REVIEW

- **Moftakhari, A.**, Bourne, S., Novoselac, A. Cooling Load Comparison of Rooms Conditioned with Radiant Cooling Panels and All-Air HVAC Systems, for *Science and Technology for the Built Environment*.

- **Moftakhari, A.**, Novoselac, A. Parametric Analysis of Cooling Load for Radiant Cooling Systems, for *Building and Environment*.

- **Moftakhari, A.**, Novoselac, A. New Convection Correlations for Ceiling Fans in Rooms with Radiant and Air systems, for *Energy and Buildings*.

- **Moftakhari, A.**, Novoselac, A. New model for cooling load calculation of light radiant cooling panels, for *Applied Energy*.

- **Moftakhari, A.**, Ippei, I., Novoselac, A. On Enhancing Cooling Capacity of Radiant Cooling Systems, for *Building and Environment*.

- **Moftakhari, A.**, Novoselac, A. Fundamentals of Cooling Load Calculation for Radiant Systems, for *Energy*.

- **Moftakhari, A.**, Novoselac, A. Modification of Heat Balance Method for Cooling Load Calculation of Radiant Systems in ASHRAE Load Calculation Toolkit, for *Journal of Building Performance Simulation*.

- Du, J., **Moftakhari, A.**, Novoselac, A. Heat Transfer Dynamics of Rooms with Radiant Floor and Ceiling Cooling Systems, for *Building Simulation*.

TECHNICAL REPORTS

- Heltzel, A.**, Moftakhari, A.**, Novoselac, A. (2021), SBIR Phase II: Passive Radiative Composite Material: National Science Foundation Project No. 1831805. PC Krause and Associates, Inc. (PCKA).
- **Moftakhari, A.**, Bourne, S., Novoselac, A. (2020), Experiment Verification of Cooling Load Calculations for Spaces with Non-Uniform Temperature Radiant Surface: ASHRAE 1729-TRP Project (No. 1729- TRP). Austin, TX: University of Texas at Austin.

SEMINARS, INVITED TALKS & CONFERENCE PRESENTATIONS

- **Moftakhari, A.**, Novoselac, A., **Paper Session 17**: Experimental Study of Radiant Systems, District Cooling Plants: ‘‘Experimental Study on Cooling Loads of Radiant and All-Air Systems’’, *ASHRAE Annual Virtual Conference*, May 2020.

- **Moftakhari, A., Seminar 06** — Updates and Lessons Learned from Recent Room Load Calculation Research: ‘‘Role of Surface Boundary Condition on the Room Convective and Radiative Loads’’, *ASHRAE Winter conference*, Orlando, FL, January 2020.

- **Moftakhari, A., Seminar 26** - Load Calculation Considerations for Radiant Systems: ‘‘Difference in Cooling Loads for Radiant and All-Air Systems for Different Load Scenarios’’, *ASHRAE Winter conference*, Atlanta, Georgia, January 2019.

- **Presenting On behalf of Novoselac, A., Seminar 26** - Load Calculation Considerations for Radiant Systems: ‘‘What Happens when Radiant Systems are Designed by Methods Developed for All-air Systems?’’, *ASHRAE Winter conference*, Atlanta, Georgia, January 2019.

- **Moftakhari, A.,** *Seminar 61: Convective Vs. Radiant Load Calculations: Are They Different?*: ‘‘ Difference in Cooling Loads for Radiant and All-Air Systems for Different Types of Heat Gains and Control (Operative vs. Air) Temperature’’, *ASHRAE Annual conference*, Houston, TX, June 2018.

SOFTWARE DEVELOPMENT

- Development, validation and extension of heat balance method (HBM) for cooling load calculation of radiant cooling systems in the ASHRAE load calculation toolkit software that can be used worldwide by HVAC designer and practitioners.

PROFESSIONAL MEMBERSHIP

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- Corresponding Member of ASHRAE Technical Committees: TC 4.1 (Load Calculation Procedure), TC 6.5 (Radiant heating and cooling systems), TC 7.5 (Smart buildings), TC5.3 (Room Air Distribution) and TC4.10 (Indoor Environmental Modeling).
- UT Austin Engineering Graduate Student Association.

SOFTWARE SKILLS

Operating systems	Microsoft Windows, Linux
Programming	MatLab, C++, Java, Python, FORTRAN77/FORTRAN90
Mechanical Engineering	ANSYS,FLUENT,CFX, OpenFOAM, STAR-CCM+, Solid Works
Architectural Engineering	Autodesk Revit, Autodesk Ecotect, Auto CAD, Sketch up
Building Energy Simulation	Modelica, EnergyPlus, OpenStudio, BEOPT, eQUEST, Carrier
Word processor	LATEX, Microsoft Office, Open Office

LANGUAGES

English, Deutsch, Persian