Dear Readers:

Welcome to the Penn State Department of Architectural Engineering 2019-20 Faculty Showcase.

Penn State Architectural Engineering is the proud home for nearly 400 undergraduate students, 120 graduate students, 25 professors, 10 practitioner instructors, and 10 staff members all working together for the betterment of the human condition. Our research pioneers innovative solutions at the interfaces of the built, natural, and social environments to achieve ultra-high-performance buildings and communities, and to improve the quality of life across the globe. Simply put, we are focused on making the world a better place for humanity by improving the spaces we live in!

It is an exciting time to be an architectural engineer! The United Nations has identified buildings as the next greatest opportunity to remedy human-caused carbon emissions. Health organizations around the world are increasingly emphasizing the effect of buildings on occupants’ health, productivity, and well-being. Our work has become more important than ever as the 21st century—with a rapidly increasing population, diminishing resources, escalating weather events, an aging infrastructure, and socio-economic globalization—creates new types of global challenges. Our department is founded on the concepts of convergent engineering and is responsive to the rapidly evolving challenges of 21st-century society that require preparing a new breed of engineers to solve global building infrastructure problems.

Our faculty come from a wide range of engineering backgrounds and have a laser-sharp focus on improving the design, construction, operation, and maintenance of buildings and communities. Through our range of research interests, we seek to improve indoor environmental quality, discover new building materials, develop new building envelope solutions, increase building energy efficiency, and design buildings as distributed nodes that generate energy, among others.

This booklet provides a summary overview of our recent research contributions. You’ll find profiles on Penn State Architectural Engineering faculty who conduct research in the four broad architectural engineering disciplines of structural, construction, lighting/electrical, and mechanical.

I hope you enjoy learning about the broad scope of activities our faculty are involved with year-round in our Faculty Showcase. We are particularly excited to hear your thoughts on our work and are open to any and all ways we can join forces to meet the challenges of the 21st century.

SEZ ATAMTURKTUR, Ph.D.
Harry and Arlene Schell Professor
Head of the Department of Architectural Engineering
Resilience and Intelligence Networked Systems

Dr. Asadi’s research interests focus on the design of resilient and intelligent critical infrastructure systems with a concentration on smart and connected networked systems; cyber-physical human systems; advancing safety by in-depth assessment of workers attention, perception, and decision making; and application of machine learning and artificial intelligence.

- Multi-Objective Optimization
- Transactive Energy
- Scenario-based Uncertainty Modeling and Power Market
- Application of Eye-tracking Technology in Construction Projects

RECENT PUBLICATIONS AND PRESENTATIONS

Resilience and Intelligence Networked Systems

- President, ASCE Global Center of Computing Excellence, 2019
- Penn State Engineering Alumni Society (PSEAS) Outstanding Advising Award, 2019.
- Outstanding Contribution in Reviewing, Journal of Electrical Power & Energy Systems, 2018

SOMAYEH ASADI
ASSISTANT PROFESSOR
ARCHITECTURAL ENGINEERING
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Decision Making under Uncertainty: Engineering Systems

Dr. Atamturktur concentrates on the development, application, and dissemination of model validation and uncertainty quantification methods. She also contributes to improving education in engineering and transforming institutions towards gender equity through retention and support.

- National Science Foundation (NSF), Professional Formation of Engineers: Revolutionizing Engineering Departments
- Best Paper Award, Model Validation and Uncertainty Quantification Technical Group, 29th International Modal Analysis Conference, 2015.

RECENT PUBLICATIONS AND PRESENTATIONS

Decision Making under Uncertainty: Engineering Systems

- Founding Director, NSF NRT-funded Resilient Infrastructure and Environmental Systems (RIES) Engineering and Science Degree Programs, 2016-2018.

HERS Clare Booth Luce Scholarship Award to participate in the Higher Education Resource Services (HERS) Summer Institute.

SEZ ATAMTURKTUR
HARRY AND ARLENE SCHELL PROFESSOR AND DEPARTMENT HEAD
ARCHITECTURAL ENGINEERING
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Energy Efficient, Economical Indoor Air Quality Control

Dr. Bahnfleth’s research considers systems that control air contaminants and the thermal environment to support occupant safety, health, productivity and comfort. The overriding objective is to provide energy efficient solutions that are cost effective.

• Laboratory, field, and modeling studies of air cleaner performance
• Multi-zone modeling and field studies of air contaminant transport in buildings
• Economic analysis including equipment and operating costs and monetized IEQ benefits

RECENT PUBLICATIONS AND PRESENTATIONS
Energy Efficient, Economical Indoor Air Quality Control

- Laboratory measurements and modeling of influence of air speed and temperature on low pressure Hg germicidal lamp output
- Prediction of dose for in-duct UVGI systems
- Field studies and modeling of VAV versus plenum return air system impact on contaminant distribution
- Rapid multi-zone model calibration procedure
- Variable primary flow chilled water system performance modeling
- Field studies and parametric modeling of stratified chilled water storage tanks

WILLIAM BAHNFLETH
PROFESSOR
ARCHITECTURAL ENGINEERING
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Dr. Boothby’s research interests encompass the structural design methods and the interpretation of structures from Ancient Greece and Rome through the present time. He has conducted research into the design of Romanesque and Gothic churches in Italy and France, masonry bridges in the U.S., and mid-century reinforced concrete shell structures in the U.S. He has recognized empirical design as the basis of all structural design, ancient and modern, and is making this the current focus of his scholarship.

RECENT PUBLICATIONS AND PRESENTATIONS


Historic Structures and Empirical Structural Design

Recent Investigations into proportioning schemes of Early Christian and Lombard Churches

THOMAS BOOTHBY
PROFESSOR
ARCHITECTURAL ENGINEERING
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Data-Driven Approaches for Early Building Design

Dr. Brown focuses on how structural considerations interact with other performance and architectural criteria in conceptual building design, as well as how computation and optimization can play a role in the creative process.

• Structural and multi-objective optimization
• Computational design tools
• Applications of data science to early parametric building design

RECENT PUBLICATIONS AND PRESENTATIONS

Data-Driven Approaches for Early Building Design

• Helped develop *Design Space Exploration*, a set of open-source design tools for data-driven design used by AEC firms around the world

• Awarded the SOM Structural Engineering Travel Fellowship – documented examples of structures designed for multiple objectives simultaneously

• Affiliated with the Stuckeman Center for Design Computing and the Institute for CyberScience at Penn State

NATHAN BROWN
ASSISTANT PROFESSOR
ARCHITECTURAL ENGINEERING
ncb5048@psu.edu
Dr. Duarte’s research centers on the use of computation to enable mass customization, defined as the design and construction of buildings and urban developments adapted to the context. His research includes generative design systems, performance simulation and optimization, responsive architecture, smart materials, and 3D printing of concrete.

- Teaching Experience: Advanced Computation Studio; Additive Manufacturing of Concrete Structures; Shape Grammars; Digital Design and Fabrication; Computer Programming for Designers; Mass Customization of Housing; Parametric Urban Design.
- Author of four books, over 30 book chapters, 50 journal articles, and 130 conference papers.

RECENT PUBLICATIONS AND PRESENTATIONS

Context-Sensitive Design and Construction

- NASA 3D-printed Mars Habitat Challenge: Phase 3 - On-Site Habitat Competition, Construction Level 3 – Subscale Habitat Competition, 2nd Prize, May 2019; Phase 2 - Structural Member Competition, Level 3 – Head-to-Head Competition, 2nd Prize, August 2018.
- Inventor of nine patents related to construction processes and products.
- Reviewer of project proposals for national science and technology foundations in Austria, Brazil, Israel, Netherlands, and Portugal.

José P. Duarte
Affiliate Professor
Architectural Engineering
jxp400@psu.edu
System Approaches to Energy Efficiency and IAQ

Dr. Freihaut’s research focuses on the following areas:

• Resuspension aerosolization of indoor PM 2.5 particles carrying natural and synthetic chemical contaminants
• UVGI deactivation of indoor microbes (bacterial and fungal) in spore and vegetative states
• Established state-of-the-art indoor aerosol research laboratory and ASHRAE 52.x standards test rig
• Systems approach to building energy efficiency  EEB Hub leading Penn State at the Navy Yard Building 661/7R complex
• CHP Enabled Distributed Energy with Renewables  Hybrid energy research facility in Building 7R

RECENT PUBLICATIONS AND PRESENTATIONS

System Approaches to Energy Efficiency and IAQ

- State-of-the-art indoor aerosol laboratory facility
- Penn State at the Navy Yard complex (661, 7R) with CHP Enabled Renewables research facility
- DOE EEB Hub project
- DOE Mid-Atlantic CHP TAP Center at PSU AE
- PA DEP contract to establish CHP Enabled Renewables research at Navy Yard
- Initiated UNECE Sustainable Building project with PSU AE as lead technical organization
- Member of Technical Review Panel for NREL ESIF, Singapore National Research Agency, Dalian University of Technology
- Technical Director, Penn State at the Navy Yard

JAMES FREIHAUT
PROFESSOR
ARCHITECTURAL ENGINEERING
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Responsive and Adaptive Building Materials

Dr. Gevaudan’s research focuses on the development, durability, and performance of both conventional and innovative cementitious materials. The mission of this research is to diversify the current suite of cementitious construction materials via the advancement of appropriate cement chemistries for specific infrastructure applications.

- 2019-2021 Marie Skłodowska-Curie Individual Fellow
- Co-PI of two (2) patents on the development of innovative and extreme-durability materials

**RECENT PUBLICATIONS AND PRESENTATIONS**

Responsive and Adaptive Building Materials

The Re-AIM research group investigates, develops, predicts, and innovates the performance of cementitious materials to solve the building and infrastructure global grand-challenge. Degradation mechanisms of cementitious materials are investigated by leveraging statistics-based experimental and computational methodologies; and merging the fields of cement chemistry, building science, and materials science.

JUAN PABLO GEVAUDAN
AFFILIATE PROFESSOR
ARCHITECTURAL ENGINEERING
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Floor Vibration Serviceability: Design, Assessment, Repair

Dr. Hanagan’s primary research focus involves serviceability of building structures, with particular emphasis on designing to avoid excessive floor vibrations, diagnosing and repairing floor vibration problems, structural control including active control of floor vibration, and experimental testing.

- AISC Faculty Fellow, American Institute of Steel Construction, 2003.

RECENT PUBLICATIONS AND PRESENTATIONS

Floor Vibration Serviceability: Design, Assessment, Repair

In addition to traditional vehicles for conducting research, Dr. Hanagan offers Floor Vibration Research Services to assist building owners, engineers, and businesses with experimental assessment and development of repair options to mitigate objectionable levels of floor vibrations from a myriad of vibration sources.

Floor Vibration Research Services are offered with two goals in mind:

1. To provide services that are not commercially available to the community by providing access to expertise and resources derived from decades of research in the area of floor vibrations for the purposes of meeting the goals of a specific sponsor.

2. To provide data and funding for student projects and advance and disseminate knowledge in the area of floor vibration behavior, design, assessment, and mitigation.

PARTNER WITH ACADEMIC EXPERTS

LINDA HANAGAN
ASSOCIATE PROFESSOR
ARCHITECTURAL ENGINEERING

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Construction Automation, Sensing, and Robotics

Dr. Jebelli’s research interests span the use of artificial intelligence in the construction industry; automation, and robotics in construction and infrastructure management; applications of wearable biosensors in the field; developing and facilitating human-centric smart and connected cities; applications of virtual and augmented reality for health and safety management of buildings and infrastructures users; blockchain technology for construction management; and the application of digital twins for pairing of virtual and physical construction sites.

RECENT PUBLICATIONS AND PRESENTATIONS

Construction Automation, Sensing, and Robotics

- Multidisciplinary educational and research background (holding master’s degrees in structural engineering, construction engineering and management, electrical engineering and computer science, biomedical engineering, and a doctoral degree in civil and environmental engineering).
- John L. Tishman Fellowship, University of Michigan.
- The Calvin C. Solem Foundation Fellowship, University of Nebraska-Lincoln.

HOUTAN JEBELLI
ASSISTANT PROFESSOR
ARCHITECTURAL ENGINEERING
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sites.psu.edu/smartlab/
Integration of Renewable Energy Sources to Grid

Dr. Khazaei’s research focuses on the application of renewable energy sources in smart grids to address climate change. He has also conducted research on stability and control of power converters and cybersecurity issues in smart grids.

- 2019 Excellence in Research Award, Penn State Harrisburg
- 2019 Best Paper Award, Second Prize, IEEE Smart Grid Asia Conference
- 2018 Outstanding Reviewer Award, IEEE Transactions on Sustainable Energy
- 2016-2017 Best Teaching Assistant Award, University of South Florida

RECENT PUBLICATIONS AND PRESENTATIONS

Integration of Renewable Energy Sources to Grid


PARTNER WITH ACADEMIC EXPERTS

JAVAD KHAZAEI
ASSISTANT PROFESSOR
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Integrated Teams: Organization, Procurement, and Technology

Dr. Leicht uses organizational theory, information and process modeling, and communication theory to research the methods of assembling integrated teams and developing integrated processes with the ultimate goal of delivering high performance buildings.

- Director, Partnership for Achieving Construction Excellence
- Owner’s Guide to Maximizing Success in Integrated Projects has been downloaded by more than 1,000 industry members and adopted by the U.S. General Service Administration
- Co-author of the BIM Project Execution Planning Guide and the BIM Guide for Owners

RECENT PRESENTATIONS

- "Exploring the capacity for Innovation in Construction.” Keynote Presentation, When Social Science meets Lean and BIM, University of Huddersfield, 8-9 January 2018.
Integrated Teams: Organization, Procurement and Technology

Organization

Procurement

Technology

ROBERT LEICHT
ASSOCIATE PROFESSOR
ARCHITECTURAL ENGINEERING
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Integrative Design through Project-Based Learning

Professor Ling focuses on integrative design practices in architectural engineering resulting in implementation of project-based learning opportunities in a five-year architectural engineering curriculum.

- Served on faculty team of CoLab design studio
- Advise and consult fifth-year students on innovative integrative design concepts resulting in highest recognition in the AEI Student Design Competition

RECENT PUBLICATIONS AND PRESENTATIONS

Integrative Design through Project-Based Learning

- **Learning through Observation** - AE496 Building Case Study, AE Summer Study Abroad Program 2018 - Beijing, Shanghai, Hong Kong
- **Learning through Service Opportunities** - AE496 Building Case Study, AE Summer Study Abroad Program 2018. Tangkou Community Center, Kaiping, Guangzhou, China
- **Architectural Engineering Institute of ASCE**, President Emeritus
- **AEI Conference 2019**, Conference Chair

**MOSES LING**  
TEACHING PROFESSOR  
ARCHITECTURAL ENGINEERING  
mdl5@psu.edu
Building Envelope Systems and Residential Construction

Dr. Memari’s research interests include experimental and analytical evaluation of building envelope systems, performance of residential and commercial buildings under natural hazards and environmental effects, building science and enclosure energy performance evaluation, BIM, and 3D printing of concrete.

• Author of over 250 publications, including papers in journals, conference proceedings, magazines, books/book chapters, and research reports.

RECENT PUBLICATIONS AND PRESENTATIONS

Building Envelope Systems and Residential Construction

- Started the new Residential Construction Minor and function as the Faculty in Charge of the new academic program, (August 2015-present).
- Initiated participation of Penn State student team in DOE Race to Zero since 2013, serving as Head Competition Advisor; Team won 1st Place out of 40 teams in the Suburban Single-Family Housing in the 2017-2018 competition.
- As Head Faculty Advisor for the NAHB Student Chapter Residential Construction Management Competition, efforts led to two National Championships: 1st Place out of 34 schools in 2014-2015, and 1st Place out of 34 schools in 2017-2018.
- Introduced a new technical conference on Residential Building Design and Construction through PHRC and served as Conference Chair for the past four conferences (2013-2018).
- Founding Editor, Special Section/Selection on Housing and Residential Building Construction, ASCE Journal of Architectural Engineering (October 2012-present).
- Patents: 1) Transparent Sustainable Wall System; 2) Earthquake Damage Resistant Glass
Transforming Project Delivery with Technology

Dr. Messner is the Director of the Computer Integrated Construction (CIC) Research Program at Penn State and a Professor of Architectural Engineering. He specializes in Building Information Modeling (BIM) and virtual prototyping research, along with globalization issues in construction.

- Chair, buildingSMART Alliance, a council within the National Institute of Building Sciences
- Chair, Research Committee, Lean Construction Institute
- Past Chair, Computing Division, American Society of Civil Engineering

RECENT PUBLICATIONS AND PRESENTATIONS

- **Focus on the Process: BIM Project Execution Planning.** Keynote Presentation. Digital Methods in AEC, Hannover University, Hannover, Germany, Sep 5.
Transforming Project Delivery with Technology

• **Leveraging Building Information Modeling (BIM) to improve project delivery**, including the development of three core sections of the National BIM Standard – US (BIM Project Execution Planning Guide, Owner’s Guide for BIM, and the Uses of BIM)

• **Integrating facility information** as demonstrated in a virtual Penn State campus model which received a 2017 Bentley Year in Infrastructure award

• **Advancing team engagement with facility information using virtual and augmented reality**, including the development of two Immersive Construction Labs to support collaboration in immersive environments

**PARTNER WITH ACADEMIC EXPERTS**

**JOHN MESSNER**

CHARLES AND ELINOR MATTS PROFESSOR OF ARCHITECTURAL ENGINEERING
ARCHITECTURAL ENGINEERING

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Lighting System Performance Modeling

Dr. Mistrick’s research focuses on computer modeling of lighting and daylighting systems, including detailed modeling of daylight integrated lighting control systems. Other areas of interest include circadian effects, discomfort glare, luminaire optical design, parametric modeling and design optimization, energy impacts of façade systems, and automated shading systems.

- Developed the DaysimPS software to model the performance of integrated lighting control systems with automated shading.
- Developed an approach to quantify the performance of a daylight integrated lighting control system configuration and layout.

RECENT PUBLICATIONS AND PRESENTATIONS

Lighting System Performance Modeling


RICHARD MISTRICK
ASSOCIATE PROFESSOR
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Dr. Obonyo’s research includes work in sustainable structural materials in masonry systems for contexts that are resource-constrained and/or hazard mitigation. She has projects in machine learning and data. She also works in the area of globalization, entrepreneurship, and science diplomacy.

- Affordable, sustainable, resilient structural materials
- Data mining and machine learning for promoting preventive health in safety
- Science diplomacy and entrepreneurship

**RECENT PUBLICATIONS AND PRESENTATIONS**

Materials, Big Data for Safety and Globalization

- Chair of 2019 Non-Convention Building Materials Conference
- Penn State’s Inaugural Global Faculty Fellow (2017)
- Penn State Global Programs Strategic Initiatives Director (WEFs NEXUS)
- Interim Director of Humanitarian Engineering and Social Entrepreneurship, Penn State University
- 2015/2016 Jefferson Science Fellow and Senior Science Advisor (Department of State/National Academy of Science)

ESTHER OBONYO
ASSOCIATE PROFESSOR
ENGINEERING DESIGN AND ARCHITECTURAL ENGINEERING
EAO4@psu.edu
Better Buildings Through Failures Research and Education

Professor Parfitt’s research is primarily focused on engineering education including the concept of creating better buildings through the study of failures and forensic techniques, as well as professional preparation of students through an effective capstone experience.

- Snow-Induced Building Failures including Site Specific Snow Load Case Study Applications.
- Active Learning and Service Learning in Forensics and Building Performance: “The Campus is our Lab” concept.
- Created Penn State Architectural Engineering multidisciplinary capstone program option with grant from the Thornton Tomasetti Foundation and the Leonhard Center for the Enhancement of Engineering Education.

RECENT PUBLICATIONS AND PRESENTATIONS

- Parfitt, M. Kevin and Bechtel, John. Zero Defects: A Focus on Project Cx and QA/QC. Building Commissioning Association / PA COAA / AIA Middle PA / Penn State University. June 5, 2018, Univ. Park.
- Failing Forward – Construction Failure Case Studies (2018), Education Committee, ASCE Forensic Engineering Division, 8th Forensic Congress.
Better Buildings Through Failures Research and Education

- **CROSS-US (Confidential Reporting on Structural Safety – United States):** Member of expert review panel
- **ASCE Forensic Engineering Division:** Forensic Engineering 8th Congress Steering Committee / Technical Program Committee. Standing Committees: Dissemination of Failure Information, Education Committee, Co-Ed Failure Case Studies in CE
- **Architectural Engineering Institute of ASCE:** Fellow AEI, Editorial Board and Former Editor, Journal of Architectural Engineering
- **Failures Investigations:** Pittsburgh Convention Center Failure, Dulles Airport Jet Center Snow Collapse, Court Qualified Expert Witness
- **Penn State Teaching Fellow, PSEAS Awards:** Outstanding Advising, Outstanding Teaching, Premier Teaching, Perez Student Advocate

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**M. KEVIN PARFITT**
PROFESSOR
ARCHITECTURAL ENGINEERING
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Intelligent Energy System Controls and Analytics

Dr. Pavlak combines modeling, sensing, data analysis, and optimization to develop intelligent control systems that improve building energy performance and increase the sustainability and resilience of the electric grid.

- Multi-objective model predictive control of building portfolios.
- Estimation of building energy flexibility and grid response potential.
- Reduced order modeling, model calibration, and control of energy systems.

**RECENT PUBLICATIONS AND PRESENTATIONS**

Intelligent Energy System Controls and Analytics

- Blockchain-enabled smart contracts for peer-to-peer energy coordination
- Modular multi-level converters for building-scale PV applications
- Optimal sizing of resources in microgrids with flexible loads
- Machine learning-based building controls
- Multi-stage transactive controls for building HVAC and energy storage systems
- Multi-sectoral optimization for cost-effective low-energy districts

GREGORY PAVLAK
ASSISTANT PROFESSOR
ARCHITECTURAL ENGINEERING
gxp93@psu.edu
Indoor Air Quality and Health Implications of Buildings

Dr. Rim’s research focuses on understanding sources, distribution, and transport of critical air pollutants in indoor environments to help engineers, architects, and building scientists achieve healthy building design and operation.

- Computational Fluid Dynamics (CFD) modeling of pollutant dynamics in buildings
- Personal exposure to indoor air pollutants associated with human activities
- Ventilation and energy performance of building mechanical systems

RECENT PUBLICATIONS AND PRESENTATIONS

Indoor Air Quality and Health Implications of Buildings

- Chair, Indoor Aerosols and Aerosol Exposure Working Group, American Association for Aerosol Research (AAAR)
- Handbook Chair, TC 4.10 (Indoor Environmental Modeling), American Society of Heating, Refrigerating and Air-Conditioning Engineers
- Best Application Paper Award, 9th IEEE International Conference on Automation Science and Engineering, Madison, WI
- Distinguished Research Associate Award, U.S. National Institute of Standards and Technology (NIST)

DONGHYUN RIM
ASSISTANT PROFESSOR
ARCHITECTURAL ENGINEERING
dxr51@psu.edu
Building Structural Systems

Dr. Said’s research is primarily focused on characterization of structural materials as well as their durability and sustainability. Part of his research studied the use of nano particles to improve the durability of concrete structures. He has also studied the seismic performance of reinforced concrete structures. His main research area is high performance concrete materials and structures as well as masonry structures.

RECENT PUBLICATIONS AND PRESENTATIONS

Building Structural Systems

- A voting member in four American Concrete Institute Committees, including Committee on Nanotechonology of Concrete.
- Recording Secretary for the Joint ACI-ASCE Committee 441 on Reinforced Concrete Columns.
- Author of over 120 publications, including papers in journals, conference proceedings, magazines, book chapters, and research reports.
- Innovative research in recycling waste materials in sustainable concrete and alkali-activated cements.
- Groundbreaking research in the use of fiber-reinforced polymers in seismic retrofit of reinforced concrete frames.
- Innovative research in the use of nano particles (nanosilica, carbon nano fibers, carbon nano tubes, graphene) in enhancement of cementitious matrix.
- Expertise in durability of construction materials.
- Expertise in knowledge-based systems and their application in structural design.
Facilities Planning, Construction, Operations, & Maintenance

Dr. Sitzabee is a senior executive serving as the Associate Vice President for Facilities Management and Planning at Penn State. He is the Chief Facilities Officer where he leads over 1500 FTEs, is responsible for a $230 million operating budget, and directs a $4.7 billion capital construction plan. Dr. Sitzabee is responsible for 32 million square feet of constructed space across Penn State’s 24 locations. He has vast construction management experience across facilities, infrastructure, and utilities areas. As a retired officer, he is a combat veteran and has served as a political military advisor. He has taught at the Air Force’s graduate school, The Air Force Institute of Technology, and at Cornell University. Dr. Sitzabee’s research interests are:

**Construction Management** – exploring systems engineering approaches for capital construction to include advance project management, legal aspects, safety, and emerging technologies (e.g. BIM, GIS)

**Asset Management** – big data management and modeling for expansive infrastructure systems to include operations and maintenance, system risk mitigation, and capital construction

**Sustainable Facilities** – innovative and emerging technologies to improve sustainable facility construction and maintenance, building commissioning, and facility energy controls
Facilities Planning, Construction, Operations & Maintenance

- Highly engaged with the facilities construction community – strong networking
- Understanding the relationship between facility condition to drive preventive maintenance strategies – reliability centered maintenance/smart systems
- Management of large portfolios of facilities inventory – asset management
- Construction safety, safety through design, and operations safety
- Alternative construction delivery methods – legal aspects of construction
- GIS to model expansive infrastructure systems – spatial analysis

WILLIAM E. SITZABEE
AFFILIATE PROFESSOR
ARCHITECTURAL ENGINEERING
wes25@psu.edu
Engineering Education and Integrated Structural Design

Dr. Solnosky’s primary research work examines complex structural building systems and the challenges in designing and integrating them with other disciplines. He also researches how to best educate future professionals. Areas of interest include:

- Technology enhanced active learning, adaptive expertise, and just-in-time learning
- Multi-disciplinary teams dynamics, open ended ill-structured problems
- Design decision-making methodologies, BIM, and early conceptualization techniques

RECENT PUBLICATIONS AND PRESENTATIONS

Engineering Education and Integrated Structural Design

- Two research questions Dr. Solnosky studies:
  - *How can we objectively make better system selection decisions?*
  - *What can be done to better prepare the next generation of engineers?*
- Lead adviser for AEI Student Design Competition teams; 50 awards to date
- Recipient of:
  - 2019 PSEAS Lawrence J. Perez Memorial Student Advocate Award
  - 2017 PSEAS Outstanding Teaching Award
  - 2017 National ACI Walter P. Moore Jr. Faculty Achievement Award
Linking Acoustic Metrics with Human Factors

Dr. Vigeant uses a combination of engineering and social science techniques to investigate the effects of room acoustics and noise on human factors of perception, performance, and stress response. She has also investigated the effects of acoustics on the neural response in the brain using fMRI.

- Research group is named “Sound Perception and Room Acoustics Laboratory” (SPRAL)
- 3M Non-Tenured Faculty Award (2017, 2018)
- Research topics: concert hall acoustics (NSF), office noise (industry), and aviation noise (FAA & NIH)

**RECENT PUBLICATIONS AND PRESENTATIONS**

Linking Acoustic Metrics with Human Factors

3D sound reproduction facility: Auralization and Reproduction of Acoustic Sound-fields, AURAS facility: 30 loudspeakers and two subwoofers in anechoic chamber

Physiological measurement capabilities
- Stress response: Skin conductance and heart rate variability
- Neural response: 16-ch EEG

Room acoustic measurement capabilities
- 3D sound measurement capabilities with 32-channel spherical microphone array
- Custom loudspeaker with 20 drivers to reproduce instrument directivities

Violin Directional Radiation Patterns (Meyer, 2009)

- 200 – 500 Hz
- 550 – 700 Hz
- 800 Hz
- 1000 – 1250 Hz

PARTNER WITH ACADEMIC EXPERTS

MICHELLE VIGEANT
ASSOCIATE PROFESSOR
ARCHITECTURAL ENGINEERING AND ACOUSTICS
mcv3@psu.edu
Optical and Thermal Performance of Advanced Façades

Dr. Wang’s research combines physical experiments, numerical analysis, data sensing and processing, and human factors to investigate optical, thermal, and energy performance of advanced façade systems and indoor illumination systems.

• National Science Foundation (NSF) CAREER Award, 2019
• Richard Kelly Award, Illuminating Engineering Society of North America, 2017
• Editorial Board, Technology, Architecture, and Design (TAD), published by Taylor & Francis and Association of Collegiate Schools of Architecture

RECENT PUBLICATIONS AND PRESENTATIONS

Optical and Thermal Performance of Advanced Façades

Bridging emerging nanomaterials and technologies to the design and modeling of advanced façade for building energy efficiency and high building performance.

Translating organisms’ self-adaptation responding to external and internal stimuli into dynamic building façades via computational modeling and simulation with embedded sensors, computation, and smart materials and structures.

Integrating AI into real-time individualized thermal / visual comfort assessment for smart lighting and environment controls in healthcare facilities.