# TABLE OF CONTENTS

## OVERVIEW

- At A Glance 4
- Ray W. Herrick Laboratories
- **2021 - 2022 Highlights** 5
  - 2021 - 2022 Herrick Demographics Breakdown 6
  - 2021 - 2022 Herrick Federal & Industrial Contributions 7
  - 2021 - 2022 Herrick Research Expenditures 8

## SUCCESS STORIES

- Student Awards & Successes 9
- Faculty Success Stories 11
- Herrick Success Stories 13

## NEW HERRICK FACULTY

- 2022 Herrick New Faculty Search 15

## FACULTY RETIREMENTS

- 2022 Herrick Retirements 16

## IN REMEMBRANCE

- Werner Soedel & Lila Cohen 17

## CENTER UPDATES

- 2022 Herrick Center Updates 19

## RESEARCH FACILITIES

- Ray W. Herrick Laboratories Overview 24

## HERRICK FACULTY

- 2022 Herrick Faculty Members 26

## HERRICK STAFF

- 2022 Herrick Staff Members 33
- 2022 Herrick Post-Doc Associates 35

## GRADUATES

- 2021 - 2022 Herrick Graduates 36
The Ray W. Herrick Laboratories turned 60 years old in 2018. We are part of the School of Mechanical Engineering. The 28+ Mechanical Engineering faculty and Architectural Engineering faculty who do research here collaborate on interdisciplinary research projects with faculty in the other Schools of Engineering and also with faculty in the College of Science, College of Health and Human Sciences, and the Purdue Polytechnic Institute. There are five main technical areas of research with some overarching themes related to energy utilization and efficiency, reduction of pollutants in the environment, quality of life, and sustainability and safety.

The main technical areas are:

1. High Performance Buildings, Thermal Systems, and Air Quality
2. Noise and Vibration Control, which includes research on Acoustics, Dynamics, and Materials
5. Manufacturing and Materials

The educational experience at Herrick combines the traditional training of aspiring researchers with exposure to industrial, governmental, and societal needs. Nearly 900 Masters and Ph.D. candidates have graduated from the Ray W. Herrick Laboratories.

Technology transfer to industry partners and disseminating through peer-reviewed publications, conferences, and short courses is an integral part of a majority of the research programs at Herrick Labs. The researchers are also widely published across the spectrum of publications from academic journals to the popular press.

MISSION
An institution dedicated to graduate education through engineering research with an emphasis on technology transfer.

VISION
To overcoming barriers between knowledge creation, transfer, and utilization for the advancement of society.

GOALS
1. Grow educational outreach activities, including fundamental, applied, and experimental short courses;
2. Build on research excellence in the following research areas: Noise and vibration control, integrated thermal and power systems, and the built environment;
3. Provide the education environment of the labs so that its graduate students are multi-disciplinary engineers who rate as the top engineering graduates in the country;
4. Recognize and promote the value of Herrick through effective brand management (internally and externally);
5. Maximize utilization of new facilities;
6. Continue recruiting top faculty, grad students, and staff to ensure long term stability and growth. Maintain world-class facilities;
7. Become a more multi- and inter-disciplinary laboratory by inviting researchers from additional departments across Purdue to become involved in research at Herrick; and
8. Develop a testing program to support staff and infrastructure.
FY2021 - FY2022 HIGHLIGHTS

**RESEARCH - FISCAL YEAR**

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<thead>
<tr>
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<th>FY2021</th>
<th>FY2022</th>
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</thead>
<tbody>
<tr>
<td>Research Expenditures</td>
<td>$16,577,687</td>
<td>$15,992,402</td>
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<td>Proposals Submitted</td>
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<td>Number of Sponsors</td>
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**STUDENTS**

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<td>Graduate Student Researchers</td>
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<tr>
<td>MS</td>
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<tr>
<td>Ph.D.</td>
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<td>Undergraduate Student Researchers</td>
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<td>Post-Doctoral Researchers</td>
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**STUDENTS GRADUATED**

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<tr>
<td>MS</td>
<td>9</td>
<td>26</td>
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<tr>
<td>Ph.D. / Post Doc</td>
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<td>19</td>
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**VISITING RESEARCHERS**

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<tr>
<td>Visiting Research Assistants</td>
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**PURDUE DAY OF GIVING**

Thanks to the incredible generosity of Purdue alumni, faculty, staff, retirees, students, parents, and friends, the University is positioned to help our students pursue their goals like never before. During the 2022 Day of Giving the University raised a record $68.2M from over 26,000 gifts!
The primary educational mission at Herrick is thesis-based graduate programs and studies. We believe that the experiential learning, the open-ended, and integrative nature of thesis-based research is an outstanding preparation for both academic and industrial careers. To complement the student/advisor relationship, Herrick offers a learning community to the student. This community includes an outstanding cohort of graduate students, as well as a staff prepared to support and teach. In many cases, the student’s research is sponsored. Sponsor representatives also participate in educational activities with the student. There are also opportunities for students to do internships in industry or government laboratories. In total, Herrick provides an outstanding educational opportunity for our graduate students.

Masters & Ph.D. Students

2021: MS (55) 34%  PH.D. (108) 66%
2022: MS (66) 38%  PH.D. (107) 62%

Domestic & International

2021: Domestic (57) 35%  International (106) 65%
2022: Domestic (57) 39%  International (106) 66%

Chose not to Identify (8)

Herrick Programs & Demographics
TOP 5 FEDERAL SPONSORS

2022
- Department of Energy
- Department of Defense
- Army of Health Services
- NASA
- NSF

2021
- U.S. Army
- NSF
- NASA
- DARPA
- U.S. Food & Drug Administration

TOP 5 INDUSTRIAL SPONSORS

2022
- Cummins
- John Deere
- Carrier
- Eaton
- Allison Transmission

2021
- KK
- 安声科技
- Allison Transmission
- Abbvie
- SHENZHEN DANYA TECHNOLOGY
Shown below is the distribution of research expenditures for FY2019 - FY2022.

<table>
<thead>
<tr>
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<th>FY2019</th>
<th>FY2020</th>
<th>FY2021</th>
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<td>University</td>
<td>$205,203.48</td>
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<td>Foreign Government</td>
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<td>$647,450.34</td>
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<td>State</td>
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FY2021

FY2022
2022 - 2023 RAY W. HERRICK ASSISTANTSHIP
The Ray W. Herrick Assistantship was established by the Herrick Foundation in 1990 to support HVAC&R graduate research. To receive this prestigious award, a student must be doing, or intending to do, thesis-based research on a HVAC&R problem of interest to industry exclusively at the Ray W. Herrick Laboratories. Yidan is pursuing a Ph.D. degree with a research focus on advanced compressor modeling and testing to study complex coupled thermo-acoustic phenomena. Yidan's work encompasses both HVAC&R compressor and NHV (noise, harshness, and vibration) that has a long history and legacy at Herrick Laboratories.

Yidan Cui was selected as the recipient of the 2022 - 2023 Ray W. Herrick Assistantship!

CONFERENCE AWARDS
HERRICK CONFERENCE AWARDS
This July, Purdue students participated in the Student Paper Competition at the 2022 Purdue Conferences. Winners included: Dongjun Mah, First Place, Buildings Conference; Andrew Fix, Second Place, Refrigeration & Air-Conditioning Conference; Parveen Dhillon, Third Place, Refrigeration & Air-Conditioning Conference; and Abhignan Saravana, First Place, Compressor Conference.

CONFERENCES
At the Society of Automotive Engineers Noise and Vibration Conference and Exposition, Zhuang Mo was awarded 2nd place and Jianxiong Feng received 3rd place. Sansit Patnaik received 2nd place in the 2022 Poromechanics Committee Student Paper Competition at the EMI 2022 Conference.
The Herrick Laboratories Student Resource Committee (HSRC) is a student-run committee that provides Herrick students, faculty, and staff with opportunities for personal and professional growth. The Herrick Student Resource Committee was led by Zachary Siefker and Nikhil Carneiro in 2021 – 2022.

Moving forward, and as we continue our recovery from the pandemic, the focus will center on re-attaining and improving the community aspect in the laboratory’s workspace. This will connect with similar efforts across the School of Engineering to ensure students are reintegrating to campus life after the COVID pandemic while promoting a healthy work/life balance. Different social and professional activities such as picnics, outdoor games (sport intramurals, winter activities), and skill-focused seminars will be pursued. Additionally, our community outreach will branch from the typical food drive to include volunteering at community centers in the Greater Lafayette area. In addition, the HLRSC would like to host monthly technical discussions with industry partners. These efforts will be led by Daniel Soto-Martínez and Reynolds Manion in 2022 – 2023. If you would like to participate, please contact Daniel or Reynolds.

Salvador Rojas and Katherine Riley each received a Best Paper Award at the 5th International Conference on Reconfigurable Mechanisms and Robots (ReMAR 2021).

Andrew Fix was selected for the IBUILD Fellowship Program managed by Oak Ridge National Laboratory with the support of U.S. Department of Energy, Building Technologies Office (BTO).

Jiselle Thornby received the Women in Defense Scholar Award. Since 1990, Women In Defense has awarded over $1,000,000 to more than 200 deserving recipients pursuing education toward a career in national security.

Elias Pergantis was the recipient of the Onassis Foundation Scholarship for his work on smart buildings connected with DC Nanogrid House.

The International Refrigeration and Compressor Course (IRCC) co-organized by Herrick Labs, Purdue University, Technical University Dresden and Oklahoma State University featured several Herrick students. Although international travel was still challenging during Summer 2021, students from Oklahoma State University managed to join the Herrick students for a hybrid experience.

HERRICK STUDENT AWARDS & SUCCESSES

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Andres Arrieta was featured in a story involving his research of “morphing” wings, which are bi-stable structures to switch a wing's shape and stiffness with a minimum amount of energy. Arrieta specializes in building structures that are bi-stable; like a slap bracelet, they snap back-and-forth between two stable states, with very little force required to actuate.

James Braun received the F. Paul Anderson Award from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). It is ASHRAE’s highest award, given once a year for notable achievement in the HVAC industry. The award is particularly special for Braun, because its namesake—heating and ventilation pioneer F. Paul Anderson—was an 1890 graduate of Purdue Mechanical Engineering. The first recipient of the award, in 1932, was air-conditioning pioneer Willis Carrier.

The National Science Foundation (NSF) has awarded James Gibert a 5-year $600,000 CAREER grant, one of their most prestigious awards in support of early-career faculty. "The overall goal of this CAREER project is to investigate the physics, and establish a mathematical foundation, that governs the interplay between topology and nonlinear and time-dependent material behavior in heterogeneous mechanical metamaterials."

The National Science Foundation (NSF) awarded Neera Jain a CAREER grant, one of their most prestigious awards in support of early-career faculty. Neera also received Purdue's Violet Haas Award. The award, given out annually by the Butler Center, is named for Violet Haas, an electrical engineering professor from 1962 to 1986, who was instrumental in the early development of the Purdue chapter of the Society of Women Engineers. Neera also received the Early Career Teaching Award at the 2022 Faculty and Lecturer Excellence Awards Banquet.

A Purdue research team led by Panagiota Karava, Jack and Kay Hockema Professor in Civil Engineering, received a grant of nearly $1 million from the National Science Foundation to develop cyber-physical systems (CPS) aimed at reducing the energy consumption of buildings.
Tian Li was awarded with a $1M, one-year ARPA-E grant under Harnessing Emissions into Structures Taking Inputs from the Atmosphere (HESTIA) program.

Greg Shaver has been elected as a fellow of Society of Automotive Engineers (SAE). The SAE Fellow Membership designation is awarded to an elite group of professionals who have made a significant impact on the mobility industry through leadership, research, publishing, innovation, and volunteering. Greg was also the recipient of the Impact on Industry Award at the 2022 Faculty and Lecturer Excellence Awards Banquet.

Davide Ziviani was awarded the Teaching for Tomorrow Fellowship for 2021-2022. Annually, the award is given to those that demonstrate talent for teaching and their contributions to the University.

A team composed of Professors David Warsinger, James Braun and Davide Ziviani was awarded $2M by the U.S. DOE Advanced Manufacturing Office (AMO) to develop a hybrid vapor-selective membrane heat exchanger for efficient passive and active convective drying.

**FACULTY PROMOTIONS**

Effective August 2022, the following faculty have received promotions. Brandon Boor and Neera Jain have been promoted to Associate Professors. David Cappelleri and Travis Horton have been promoted to Full Professors. Congratulations!
**Contract Testing**

This past year we executed 6 contract testing agreements at Herrick across 2 disciplines. These agreements are a great opportunity to do small scale testing utilizing our technical staff to impact product development in industry.

Here are a few words from Gopal Mathur at Acoustic Meta Materials on the importance of laboratory testing for Acoustic Meta Materials. "Prototyping and testing at AMM are ongoing processes where the designers/developers seek continuous validation from standard testing process. Testing is the single most effective way of knowing how a product will perform in the market before it performs. Prototype testing of our futuristic designs/products at Herrick laboratories, Purdue University has provided us with the valuable asset of a standard laboratory setting with dependable instrumentation and technical support. It has helped us validate our engineering tools/methods and projects and to select the best performing design. Testing has allowed us far more quantitative decision-making that also hastens the discovery of what works and what doesn't. The ultimate goal of experimental testing of pre-production prototypes is that it contributes towards the validation of our futuristic designs, which can then be marketed to generate revenue for the company."

**Herrick Conferences**

The 50th Anniversary of the Herrick Conferences was held July 11 - 14, 2022. This marked the first in-person conference since 2018. 352 papers were presented to more than 650 attendees from over 30 countries.

The first International Compressor Conference was held at Purdue in 1972. This year we were joined by several special guests including Johny Green from NREL, Johnson Space Center Director Vanessa Wyche and XM Radio Founder Gary Parsons.

The 2024 Conferences will be held July 15 - 18, 2024.
NASA Visit
Vanessa E. Wyche, the director of NASA’s Johnson Space Center was the keynote speaker for the 2022 Herrick Conferences. Director Wyche spent time at the Ray W. Herrick Laboratories learning about ReTHi and other incredible work happening around the labs.

Jill Hruby
U.S. administrator for nuclear security and Purdue University alumna Jill Hruby (ME, ‘81), received an honorary doctorate from the College of Engineering on May 13, 2022 at the university’s spring commencement.

Jennifer Rumsey
Ray W. Herrick would like to congratulate ME Alum, and friend of the laboratories, Jennifer Rumsey for her promotion to CEO of Cummins, effective August 1, 2022. Cummins has deep roots in research at Herrick Laboratories.

Industrial Advisory Committee
The Industrial Advisory Committee (IAC) has continued to be a integral part of a successful relationship with industry and the labs. The IAC has increased their presence by changing the format to two annual meetings. The spring meeting is a business review while the fall maintains a focus on student projects. A special thank you to our 2021-2022 IAC Members:

- Marcus Bianchi, NREL
- Dan Conrad, Hussmann Corp.
- Robert Comparin, Emerson
- Jon Douglas, Johnson Controls
- Kirk Drees, The Drees Group, LLC
- David Florkiewicz, Ford
- Daniel Fotsch, Rolls-Royce Corporation
- Joseph Gahimer, Cummins
- John Galbraith, Daikin Applied Americas
- Paul Gloeckner, Cummins
- John Grace, Retired
- Nishi Gupta, Change Logic
- Neal Herring, Raytheon Technologies
- Carl Johnson, Retired
- Brian Joyal, Veridiam
- Christopher Kafura, Carrier
- Jason LeRoy, Trane Technologies
- Mary Lombardo, Collins Aerospace
- Terry Manon, Retired
- Mike Moaveni, Detroit Edison Company
- John Nalevanko, Ford
- Robert Parrin, Bobkat Partners, LLC
- Steve Sorenson, Toyota Technical Center
- Brad Till, Boeing Commercial Airplanes
- Don Ufford, NIST
- Fred Vance, Aero Technolgies

Welcome to our new 2022-2023 members: Rudy Chervil (Daikin), Danan Dou (John Deere), Doug Hansel (Allison Transmission), Jim McCarthy (Eaton), and Kevin Mercer (Rheem).
STARTING AUGUST 2022
KEVIN KIRCHER
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING

BIO: Kevin works on control, optimization, and machine learning methods for energy systems in buildings, focusing on their interactions with the power grid. He is particularly interested in new technologies for efficient electric heating. Kevin likes to validate methods through field experiments, often in collaboration with campus building operators.

EDUCATION
• Postdoctoral Associate in Electrical Engineering and Computer Science, Massachusetts Institute of Technology
• Ph.D. in Mechanical Engineering, Cornell University, ’19
• MS in Mechanical Engineering, Cornell University, ’16
• MEng in Engineering Physics, Cornell University, ’09
• BS in Applied Mathematics and Physics, University of Wisconsin-Milwaukee, ’08

STARTING AUGUST 2023
RILEY BARTA
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING

BIO: Riley Barta currently is the Refrigeration Team Leader and Alexander von Humboldt Research Fellow at the Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology at the Technical University of Dresden. He will join the Herrick faculty in August 2023. His research team conducts experimental and numerical research on vapor compression systems for a broad range of applications, waste heat utilization, refrigerant mixtures and behavior with lubricants, and aircraft fuel cell thermal management.

EDUCATION
• Ph.D. in Mechanical Engineering, Purdue University, ‘20
• MS in Mechanical Engineering, Purdue University, ‘16
The 2021-2022 academic year saw the retirement of two long-time Herrick faculty. We are forever grateful for their contribution and impact they made to the Labs, Industry, and the Purdue community. We wish them the best in their retirements.

**QINGYAN (YAN) CHEN**

JAMES G. DWYER PROFESSOR OF MECHANICAL ENGINEERING
PH.D., DELFT UNIVERSITY OF TECHNOLOGY, '88

**RESEARCH INTERESTS:**
Indoor and outdoor airflow modeling by computational fluid dynamics (CFD) and measurements
• Building ventilation systems • Indoor air quality (IAQ) • Energy analysis

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**KAI MING LI**

PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF CAMBRIDGE, '87

**RESEARCH INTERESTS:**
Computational acoustics • Physical acoustics • Control of environmental noise • Outdoor sound propagation • Prediction and abatement of transportation noise • Speech intelligibility in built environments
WERNER SOEDEL, 1936 - 2022

Werner Soedel, who served as a Professor of mechanical engineering at Purdue for 41 years, passed away. Dr. Soedel was born in 1936 in Prague, Czechoslovakia, to Hermann Soedel and Gertrud Fritsche Soedel. In 1967, Purdue University appointed Dr. Soedel Assistant Professor of Mechanical Engineering. In 1971 and 1975 he was promoted to Associate and Full Professor of Mechanical Engineering, respectively. Later, in 2002, he was named the Herrick Professor of Engineering Chair. He served as chairman of the Mechanics Area Committee of the School of Mechanical Engineering from 1983 until his retirement in 2008.

Dr. Soedel's interests in teaching and research were in Mechanics, particularly the vibrations of solids, liquids and gases. This included structural vibrations and acoustics. His research extended to mathematical modeling and computer simulation of machinery dynamics. He was also very interested in the history of Mechanics. Dr. Soedel was author or co-author of 234 publications in scientific journals and conference proceedings. He received the Purdue Mechanical Engineering Solberg Teaching Award twice, in 1972 and 1976. He also received the Ruth and Joel Spira Award in 1978. In 1986, he was awarded the National Ralph Coates Roe Award for Teaching and Research by the American Society of Engineering Education. Dr. Soedel served on the Editorial Board of the Journal of Sound and Vibration, published in England, and was the American Editor of this journal from 1989 until 2008. He was named an Outstanding Mechanical Engineer by Purdue in 2013.
LILA COHEN, 1925 - 2021

Lila Cohen, wife of former Herrick Director Ray Cohen, passed away this past December. Born on October 31, 1925, Lila loved entertaining in her gracious home. As her final legacy, she published a cookbook, "From My Kitchen To Yours", in November 2021, with all proceeds benefiting The Caring Place, in Valparaiso, Indiana. Lila was also a lifelong volunteer and activist for causes that enrich the lives of community, women and children.

Those wishing to honor Lila's memory are encouraged to donate to The Caring Place, Inc., 607 Bullseye Lake Road, Valparaiso, IN 46383.

2021 CHPB MEMBERSHIPS & PROJECT FUNDING

During 2020, CHPB featured 15 company members and 10 projects were funded spanning equipment, sensing, and building envelope topics.

2021 CHPB MEMBERS

BELIMO  Carrier  DUKE ENERGY  EMERSON  GMCC  Goodman
LENNOX  LG  Johnson Controls  REGAL  SOUTHERN CALIFORNIA EDISON  TRANE

2022 PROJECT FUNDING

CHPB has funded 11 projects with 15 different faculty members as PI/Co-PI. In addition, CHPB also seed-funded 4 additional projects through the first two quarters to enable additional research and attract new companies.

2022 MEMBERS

BELIMO  Carrier  DAIKIN  DUKE ENERGY  EMERSON  GE APPLIANCES
GMCC  GREE  Honeywell  Johnson Controls
LENNOX  LG  REGAL  Rheem  SOUTHERN CALIFORNIA EDISON  TRANE

16 COMPANY MEMBERS  11 FUNDED PROJECTS  15 PIs/CO-Pis
HERRICK CENTER UPDATES

CENTER FOR HIGH PERFORMANCE BUILDINGS

During the last academic year, the CHPB has seen a growth in membership, faculty, research endeavors and educational activities despite the continued challenges caused by the COVID-19 pandemic.

At the beginning of 2021, the CHPB membership included a total of 13 companies with a mix of equipment manufacturers and utilities, which supported 10 regular projects and 2 seed-funded projects. Following the 2021 CHPB Spring meeting activities, three additional companies, i.e. Honeywell, Rheem and GE Appliances/Haier, decided to join the center and broaden the membership. As part of the 2021 CHPB Fall meeting (hosted virtually), 11 regular projects were selected along with 4 seed-funded projects. A total of 14 faculty PI/Co-PIs and 25 students were involved in CHPB-related activities.

After 2 years of virtual meetings, the 2022 CHPB Spring meeting was hosted with a hybrid format and welcomed 11 CHPB members in-person and more than 80 members online. During the center meeting, faculty pitched 8 new concept proposals that will be evaluated during the 2022 CHPB Fall meeting, which is planned on October 19-20 followed by the Herrick IAC. During Spring 2022, a Center Leadership Council was formed to coordinate research and educational efforts with other centers such as CEEE at the University of Maryland, ACRC at the University of Urbana-Champaign, and CIBS at Oklahoma State University.

In Spring 2022, CHPB and Herrick Labs expanded the faculty list by adding two new hires in the area of Smart Building Systems: Kevin Kircher (starting date August, 2022) and Riley Barta (former Herrick PhD student, starting date August, 2023).

Since 2021, the CHPB has expanded efforts in promoting/supporting undergraduate research and educational activities. Notably, Profs. Horton, Qu and Ziviani were selected as faculty members as part of the “jump into STEM” program supported by the U.S. DOE BTO, and three national labs (ORNL, NREL and PNNL).
HERRICK CENTER UPDATES

RESILIENT EXTRA-TERRESTRIAL HABITAT INSTITUTE
After two years of virtual meetings, the RETH institute held their annual review in-person on June 13-14, 2022. NASA and industry visitors viewed demonstrations of the robotic modular end-effector system and of the cyber-physical space habitat testbed (CPT), both being developed at Herrick Labs. The CPT, currently being designed and assembled, aims to couple realizable physical habitat subsystems with computer modeled subsystems, where necessary, in order to validate the institute’s resilience approach with real-world uncertainties. Vanessa Wyche, director of the Johnson Space Center, also took time to meet with the CPT development team in July while on-site for Herrick Conferences. Learn more on the institute’s website (https://www.purdue.edu/rethi/).

On October 13-14, the institute co-hosted an interdisciplinary workshop in San Antonio, Texas to establish a “cross-disciplinary academic, government, and industry community dedicated to identifying, developing, and evaluating applications of advanced technologies to support deep space exploration missions.” To learn more (https://smarthabworkshop.org/).

INTERNET OF THINGS 4 PRECISION AGRICULTURE
IoT4Ag was established on September 1, 2020. In Year 2, the Center has had excellent growth and execution of its programs and activities that deliver on the IoT4Ag strategic plan across the four pillars: convergent research, engineering workforce development, diversity and culture of inclusion, and innovation ecosystem. To-date participants in IoT4Ag Research include: 16 Postdoctoral Associates, 59 Ph.D. students, 17 M.S. students, and 51 undergraduate students.

This June 15-17, 125 IoT4Ag members, including students, REUs, faculty, staff, and advisory board members were able to come together, in-person, at Purdue University for the IoT4Ag Annual Meeting. A “boot camp” organized by and for the students was held in advance on June 14-15. The guiding principle for the agenda was to hold activities across all four ERC pillars that could only be done in-person. The IoT4Ag team members were able to tour Purdue’s campus and impressive facilities, featuring those at the Herrick Laboratories.
PURDUE ENERGETICS RESEARCH CENTER
In August, Purdue and the Army Research Laboratory forged a cooperative agreement focused on the development of new energetic materials, manufacturing processes, and modeling and diagnostic tools. The 3-year, $24.7M project is one of the largest research contracts in Purdue history, and will be completed primarily at the Maurice J. Zucrow and Ray W. Herrick Laboratories.

During the summer of 2021, as part of the Advancing Army Modernization Priorities through Collaborative Energetic Materials Research (AAMP-EM) project, Purdue hosted the first summer undergraduate program called AAMP-UP!'21. This program included 25 students from Purdue and other universities during a 10-week student-centered, experiential, research program for undergraduates to help further their academic and professional goals. The program was a tremendous success with year 2 of the program already in the works.
THE THERMAL SYSTEMS LABORATORIES

These areas are where the HVAC and Refrigeration component-level and system-level technology research is conducted, as well as research on Air Quality. Three pairs of psychometric chambers: each 7,000 cubic feet, with 5-ton testing capacity and precise temperature and humidity control. Designed to accommodate ASHRAE/ARI test procedures. Sixteen geothermal bores: 300 feet deep, with variable flow rates and numerous temperature sensors. A 90-ton centrifugal chiller and ice storage test facility; computer-controlled compressor load stands; psychrometric wind tunnel with dust injection system. There are two indoor air quality (IAQ) laboratories that can simulate indoor and outdoor conditions. Instrumentation includes ultrasonic anemometers, omni-directional anemometers, tracer-gas sampler and analyzer, and particle generators and analyzers.

THE LIVING LABORATORY & SUSTAINABLE BUILDINGS

Herrick Laboratories is a living laboratory where the built environment is being studied. It includes a 16 bore geothermal field and plug-and-play heat rejection for experiments in the engines and thermal sciences laboratories. Four, almost-identical 34’ x 37’ office spaces for human-building interaction and building technology studies; completely customizable temperature, humidity, airflow patterns, and acoustic treatments; reconfigurable indoor lighting, daylighting/shading controls, mechanical cooling and ventilation controls, and more; thermal delivery by ceiling, floor or side walls, including radiant-floor heating and radiant-chilled beam cooling; replaceable south-facing building envelopes. The normal temperature range is 65° F to 75° F but this can be extended to 55° F to 85° F. Relative humidity can be varied from 20% to 80%. Three of the units have double skin facades with different options for ventilation and energy recovery. All of the offices spaces have separate equipment for providing space conditioning that are well instrumented to allow direct energy comparisons.

ENGINES RESEARCH LABORATORY

There are four test cells that are home to engine and hybrid systems controls research that is focused on improving efficiency, reducing engine emissions and developing efficient and environmentally friendly systems for using alternative fuels. The four test cells support 670, 350, 150 and 150 HP engine testing respectively. A hydraulic variable valve actuation system capable of controlling 12 valves, a single cylinder rig for testing piezoelectric valve actuation, and an AC dynamometer and several eddy-current engine dynamometers, as well as emissions sensing systems.
HIGH-BAY FLEXIBLE LABORATORY & SMALL-SCALE VIBRATIONS LABORATORY

These spaces house electro-mechanical systems, additive manufacturing, and vibrations research. This is comprised of two parts: an open 36 by 87 ft. high-bay area with segmented floors for vibration isolation between experiments, and a smaller laboratory for smaller scale experiments. The high-bay area has high ceilings to accommodate large systems for testing. It can house large shakers, such as a 35 kN TIRA electrodynamic shaker that can be used to reproduce vibration profiles and has in-built hydraulic power supplies for hydraulic shakers. In this area, the vibration and dynamics of larger structures can be examined such as building components, vehicle suspension systems, wind turbine blades, road vehicle and aircraft and space structures. The 700 sq. ft. small-scale laboratory includes apparatus for the dynamic testing of materials and small structures to investigate nonlinear dynamic behavior and to identify structural and material parameters.

ACOUSTICS, NOISE AND VIBRATION RESEARCH AREA

In addition to the facilities in the High-Bay Flexible Laboratory and Perception-Based Engineering areas, these facilities include a 25 by 20 by 18 ft. reverberation room, an anechoic room with useful volume of 12 by 12 by 12 ft., a hemi anechoic room with useful volume of 41 by 27 by 18 ft. and an 8 by 8 ft. audiometric room for sound quality testing. There is also an acoustical materials laboratory with several types of impedance tubes for standardized acoustic material testing. The reverberation room is configured for sound transmission testing of acoustical systems. Additional facilities include a tire pavement test apparatus (TPTA) for testing tires on realistic pavements at speeds up to 50 km/hr, a two wheel chassis dynamometer with 67 inch rollers, an anechoic wind tunnel with 18 by 24 inch test section and flow velocity up 120 mph. Instrumentation includes a 64 microphone acoustical holography array and 90 channel data acquisition system, various microphones, accelerometers, shakers, laser vibrometers, and a high-speed camera.

PERCEPTION-BASED ENGINEERING LABORATORY

Perception-Based Engineering (PBE) researchers study people’s perceptions of stimuli, their influence on satisfaction, comfort, annoyance and performance and the relationship between those outcomes and the system, design and operational parameters. PBE faculty at Purdue work on projects related to touch interfaces, sound and vibration quality, image quality and depth perception, display design and graphics optimization, effects of noise on performance, and human-computer interaction. This 43 ft. by 28 ft. laboratory houses a TEAM 6 degree-of-freedom shaker, which can be covered when not in use. Lighting, temperature (55° F - 85° F), humidity (20% to 80%) and sound can be finely controlled, and the room can be re-configured as several small isolated rooms or one larger room, thus simulating various types of environments.
ANDRES ARRIETA
ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF BRISTOL, UNITED KINGDOM, ’10

RESEARCH INTERESTS:
Adaptive structures • Mechanical metamaterials • Robotic materials • Programmable structures
• Multistable structures • Structural nonlinearity • Elastic instabilities • Structural dynamics
• Nonlinear vibrations

ANIL K. BAJAJ
ALPHA P. JAMISON PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF MINNESOTA, ’81

RESEARCH INTERESTS:
Modeling of nonlinear systems • Structural dynamics and localization • Flow-induced vibrations
• Impacting systems • Bifurcations and chaos

ANTONIO BOBET
EDGAR B. AND HEDWIG M. OLSON PROFESSOR OF CIVIL ENGINEERING
PH.D., MASSACHUSETTS INSTITUTE OF TECHNOLOGY, ’97

RESEARCH INTERESTS:
Engineering geology • Underground construction • Rock mechanics • Fracture mechanics

J. STUART BOLTON
PROFESSOR OF MECHANICAL ENGINEERING
PH.D. SOUTHAMPTON, ’84

RESEARCH INTERESTS:
Acoustics • Active and passive noise control • Sound field visualization • Structural acoustics
and wave propagation in structures • Noise control material modeling • Applied signal processing

BRANDON E BOOR
ASSOCIATE PROFESSOR OF CIVIL ENGINEERING
PH.D., THE UNIVERSITY OF TEXAS AT AUSTIN, ’15

RESEARCH INTERESTS:
Indoor air quality (IAQ) • HVAC filtration • Human exposure assessment • Airborne nanoparticles
• Bioaerosols (fungi, bacteria, pollen, allergens) • Air quality in occupational workplaces • Parti-
cle adhesion & resuspension • Early-life/infant exposures • Combustion aerosols & wood smoke
• New particle formation • Urban air pollution • Low-cost air quality monitoring • Health effects
of air pollution • Fate & transport of VOCs/SVOCs.
JAMES E. BRAUN
HERRICK PROFESSOR OF ENGINEERING
DIRECTOR OF THE CENTER FOR HIGH PERFORMANCE BUILDINGS
PH.D., UNIVERSITY OF WISCONSIN, '88
RESEARCH INTERESTS:
Modeling, analysis, and control of thermal systems

DAVID CAPPELLERI
PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF PENNSYLVANIA, '08
RESEARCH INTERESTS:
Multi-scale robotic manipulation and assembly • Mobile micro/nano robotics • Micro/nano aerial vehicles • Micro-Bio robotics • Mechatronics • MEMS/NEMS • Automation for the life sciences

JUN CHEN
ASSISTANT HEAD FOR FACILITIES AND OPERATIONS
ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING
PH.D., JOHNS HOPKINS UNIVERSITY, '04
RESEARCH INTERESTS:
Experimental fluid dynamics • Development of flow diagnostic techniques • Flow dynamics in stratified environment • Turbulent flow measurements and modeling

GEORGE T. C. CHIU
ASSISTANT DEAN FOR GLOBAL ENGINEERING PROGRAMS
PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF CALIFORNIA-BERKELEY, '94
RESEARCH INTERESTS:
Dynamic systems and control • Mechatronics • Digital and functional printing and fabrication • Motion and vibration control and perception • Embedded systems and real-time control

REBECCA CIEZ
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
PH.D., CARNEGIE MELLON UNIVERSITY, '18
RESEARCH INTERESTS:
Energy technologies • Economics • Decision-making processes • Decarbonized energy systems
PATRICIA DAVIES
PROFESSOR OF MECHANICAL ENGINEERING
PH.D., SOUTHAMPTON, '85

RESEARCH INTERESTS:
Sound quality • Signal processing • Data analysis • System modeling and identification • Condition monitoring of machinery • Perception-based engineering • Seat-occupant modeling

SHIRLEY J. DYKE
PROFESSOR OF MECHANICAL ENGINEERING AND CIVIL ENGINEERING
PH.D., UNIVERSITY OF NOTRE DAME, '96

RESEARCH INTERESTS:
Structural dynamics and control • Cyber-physical systems • Machine vision • Real-time hybrid simulation • Damage detection and structural condition monitoring • Cyberinfrastructure development

JAMES GIBERT
ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING
PH.D., CLEMSON UNIVERSITY, '09

RESEARCH INTERESTS:
Vibrations and nonlinear dynamics • Smart material systems • Non-pneumatic tires • Optimization of mechanical systems • Additive manufacturing

MARCIAL GONZALEZ
ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING
PH.D., CALIFORNIA INSTITUTE OF TECHNOLOGY, '11

RESEARCH INTERESTS:
Predictive, multi-scale modeling and simulation of microstructure evolution in confined granular systems, with an emphasis in manufacturing processes and the relationship between product fabrication and performance • Particulate products and processes • Continuous manufacturing • Performance of pharmaceutical solid products

ECKHARD A. GROLL
WILLIAM E. AND FLORENCE E. PERRY HEAD OF MECHANICAL ENGINEERING
REILLY PROFESSOR OF MECHANICAL ENGINEERING
"DOKTOR-INGENIEUR" (DOCTOR OF ENGINEERING), UNIVERSITY OF HANNOVER, '94

RESEARCH INTERESTS:
Thermal sciences as applied to HVAC&R systems and equipment
W. TRAVIS HORTON
PROFESSOR OF CIVIL ENGINEERING
PH.D., PURDUE UNIVERSITY, '02

RESEARCH INTERESTS:
Advanced thermal energy conversion systems • Energy utilization in buildings, and the interactions between a building and its environment • Development of advanced, highly integrated, heating, ventilating, air conditioning, and refrigeration systems

Mohammad Reza Jahanshahi
ASSOCIATE PROFESSOR OF CIVIL ENGINEERING
PH.D., UNIVERSITY OF SOUTHERN CALIFORNIA, '11

RESEARCH INTERESTS:
Autonomous sensing • Data interpretation • Intelligent condition assessment of structures

Neera Jain
ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN, '13

RESEARCH INTERESTS:
Dynamic modeling and optimal control • Model predictive control • Decentralized control • Thermodynamics-based optimization • Entropy generation minimization • Exergy analysis • Integrated energy management and storage in distributed energy systems • Building systems

PANAGIOTA KARAVA
JACK AND KAY HOCKEMA PROFESSOR OF CIVIL ENGINEERING
PH.D., CONCORDIA UNIVERSITY, '08

RESEARCH INTERESTS:
Smart buildings, intelligent building operation, system identification, model predictive control • Human-building interactions, personalized control, self-tuned environments • Smart and connected energy-aware residential communities • Energy efficient and mixed-mode buildings, innovative energy and comfort delivery systems • Solar technology integration in building operation

Kevin Kircher
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
PH.D., CORNELL UNIVERSITY, '19

RESEARCH INTERESTS:
Control, optimization, and machine learning methods for energy systems in buildings, focusing on their interactions with the power grid • New technologies for efficient electric heating • Validation methods through field experiments • Collaboration with campus building operators.
2022 HERRICK FACULTY

CHARLES M. KROUSGRILL
150TH ANNIVERSARY PROFESSOR OF MECHANICAL ENGINEERING
PH.D., CALIFORNIA INSTITUTE OF TECHNOLOGY, '80

RESEARCH INTERESTS:
Dynamics • Nonlinear vibration of continuous systems • Stability analysis

TIAN LI
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
PH.D. UNIVERSITY OF MARYLAND, '15

RESEARCH INTERESTS:
Naturally nanostructured materials • Energy, water, and wearable technology • Manufacturing

YANGFAN LIU
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
PH.D., PURDUE UNIVERSITY, '16

RESEARCH INTERESTS:
Acoustic Source Modeling and sound field reconstruction • Active noise control • Room acoustics simulation and auralization • Noise control treatments • Human perception of noise

AMIN MAGHAREH
RESEARCH ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
PH.D., PURDUE UNIVERSITY, '17

RESEARCH INTERESTS:
Design • High-performance buildings

MONIQUE MCCLAIN
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
PH.D., PURDUE UNIVERSITY

RESEARCH INTERESTS:
Dissimilar material 3D printing • Additive manufacturing of energetic materials • Additive manufacturing of materials for high temperature applications • Quality control in additive manufacturing
JEFFREY RHOADS
DIRECTOR OF HERRICK LABS AND PROFESSOR OF MECHANICAL ENGINEERING
PH.D., MICHIGAN STATE UNIVERSITY, '07

RESEARCH INTERESTS:
Nonlinear dynamics and vibration • Resonant micro/nanosystems • Microscale sensors and actuators • Solid mechanics • Energetic materials • Additive manufacturing

FABIO SEMPERLOTTI
ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING
PH.D., THE PENNSYLVANIA STATE UNIVERSITY, '09

RESEARCH INTERESTS:
Structural health monitoring • Wave propagation • Structural dynamics and vibration control • Adaptive structures • Periodic structures and acoustic metamaterials • Energy harvesting • Thermoacoustics

MING QU
PROFESSOR OF CIVIL ENGINEERING
PH.D., CARNEGIE MELLON UNIVERSITY, ’08

RESEARCH INTERESTS:
Solar cooling and heating systems • Building heat transfer • Building energy supply systems • Building controls and operations • Building and building system modeling & simulation • Sustainable building design and analysis • Building system integration dedicated to sustainable and healthy built environments

JULIO A RAMIREZ
KARL H. KETTELHUT PROFESSOR OF CIVIL ENGINEERING
NHERI-NCO CENTER DIRECTOR
PH.D., UNIVERSITY OF TEXAS AT AUSTIN, ’83

RESEARCH INTERESTS:
Structural analysis and design of reinforced and prestressed concrete structures, with emphasis on seismic performance of concrete buildings and infrastructure • Structural models and experimental methods • Design codes for structural concrete

PETER H. MECKL
PROFESSOR OF MECHANICAL ENGINEERING
PH.D., MASSACHUSETTS INSTITUTE OF TECHNOLOGY, ’88

RESEARCH INTERESTS:
Motion and vibration control • Adaptive control • Intelligent control using fuzzy logic and neural networks • Engine and emissions diagnostics • Robotics
GREGORY M. SHAVER
PROFESSOR OF MECHANICAL ENGINEERING
PH.D., STANFORD UNIVERSITY, '05

RESEARCH INTERESTS:
Model-based system and control design of commercial vehicle power trains • Connected and automated commercial vehicles • Internal combustion engine & after-treatment system design and controls • Flexible valve actuation in diesel and natural gas engines

ATHANASIOS (THANOS) TZEMPELIKOS
PROFESSOR OF CIVIL ENGINEERING
PH.D., CONCORDIA UNIVERSITY, '05

RESEARCH INTERESTS:
Design, operation and optimization of high performance buildings • Daylighting, design and control of dynamic facade and shading systems • Indoor environmental (thermal and visual) quality and comfort • Occupant preferences and interaction with building systems • Radiant building systems • Solar energy applications in buildings • Building energy modeling and simulation

BIN YAO
PROFESSOR OF MECHANICAL ENGINEERING
PH.D., UNIVERSITY OF CALIFORNIA-BERKELEY, '96

RESEARCH INTERESTS:
Adaptive and robust control • Nonlinear control • Precision control of mechanical systems • Vehicle control • Robotics

DAVIDE ZIVIANI
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
ASSOCIATE DIRECTOR OF THE CENTER FOR HIGH PERFORMANCE BUILDINGS
PH.D., GHENT UNIVERSITY (BELGIUM), '17

RESEARCH INTERESTS:
Advanced heat pumping/heat engine technologies and their equipment • Positive displacement compressors and expanders • High performance buildings • Thermal management systems

FACULTY PUBLICATIONS
Recent Herrick faculty publications can be found on the Herrick website.
2021 - 2022 HERRICK STAFF

ASHLEY ANCIL
SAFETY OFFICER

BRIAN BARRETT
MARKETING AND COMMUNICATIONS SPECIALIST

DIANE COLLARD
RESEARCH SCIENTIST

HEMANTH DEVARAPALLI
CHPB RESEARCH SUPPORT ANALYST

AMANDA ELDRIDGE
ADMINISTRATIVE ASSISTANT

BRYCE GEESEY
RESEARCH ENGINEER

MARALEE HAYWORTH
MANAGING DIRECTOR, RAY W. HERRICK LABORATORIES

ERIC HOLLOWAY
DIRECTOR, INDUSTRY RESEARCH

KWOK (FRANK) LEE
ENGINEERING TECHNICIAN
2021 - 2022 HERRICK STAFF

JOSE LOPEZ ROMERO
ENGINEERING TECHNICIAN

RYAN THAYER
RESEARCH TECHNICIAN

VICKY DEARDRUFF
CUSTODIAL SERVICES

LINDSEY MACDONALD
WRITER/EDITOR

ALEX VAN ALLEN
TECHNICAL SERVICES
PROJECT MANAGER

DEAN SMOLL
ENGINEERING TECHNICIAN

SARAH WILLIAMS
ADMINISTRATIVE ASSISTANT
2021 - 2022 HERRICK POST DOC RESEARCH ASSOCIATES

FRANCESCO DANZI
POST DOC RESEARCH ASSOCIATE

ZAMZAM GOLMOHAMMADI
POST DOC RESEARCH ASSOCIATE

ALANA LUND
POST DOC RESEARCH ASSOCIATE

CHUNJIAN PAN
POST DOC RESEARCH ASSOCIATE

YIMING WANG
POST DOC RESEARCH ASSOCIATE

HONGFEI ZHU
POST DOC RESEARCH ASSOCIATE
2021 - 2022 HERRICK LAB GRADUATES

SHUBHAM AGNIHOTRI
DEGREE: M.S., 2021  PROFESSOR: GREGORY M. SHAVER
THESIS: EFFICIENCY IMPROVEMENT ANALYSIS FOR COMMERCIAL VEHICLES BY (I) POWERTRAIN HYBRIDIZATION AND (II) CYLINDER DEACTIVATION FOR NATURAL GAS ENGINES

MICHAEL ANTHONY
DEGREE: M.S., 2022  PROFESSOR: GREGORY M. SHAVER
THESIS: NOVEL THREE-WAY-CATALYST EMISSIONS REDUCTION AND GT-POWER ENGINE MODELING

SAI SWAPNEEL ARANKE
DEGREE: M.S., 2021  PROFESSOR: TIAN LI
THESIS: CELLULOSE BASED THERMOCHROMIC SMART WINDOW SYSTEM

MEGAN ARMSTRONG
DEGREE: M.S., 2022  PROFESSORS: JEFFREY RHOADS / STEVEN F. SON
THESIS: NON-THESIS

BRENNEN BOWEN
DEGREE: M.S., 2022  PROFESSORS: JEFFREY RHOADS / BRYAN W. BOUDOURIS
THESIS: FIRST STEP TOWARD A RADICAL POLYMER-BASED CONDUCTIVE ENERGETIC MATERIAL

JOHN BREHLM
DEGREE: M.S., 2022  PROFESSOR: ECKHARD A. GROLL / DAVIDE ZIVIANI
THESIS: IMPACT OF HIGH-EFFICIENCY AND VARIABLE-SPEED MOTORS ON THE PERFORMANCE OF A RESIDENTIAL SPLIT-SYSTEM HEAT PUMP

LEON BRENDEL
DEGREE: PH.D., 2021  PROFESSOR: ECKHARD A. GROLL / JAMES E. BRAUN
THESIS: VAPOR COMPRESSION REFRIGERATION IN MICROGRAVITY
NIKHIL CARNEIRO
DEGREE: M.S., 2021
PROFESSOR: JEFFREY RHOADS
THESIS: THE DEVELOPMENT OF CHEMI-SELECTIVE SENSORS TO DETECT VOLATILE ORGANIC COMPOUNDS AND FLAMMABLE REFRIGERANTS

DANIEL CARR
DEGREE: PH.D., 2021
PROFESSOR: PATRICIA DAVIES
THESIS: PERCEPTION OF WIND NOISE IN VEHICLES

WAN KYN CHAN
DEGREE: M.S., 2021
PROFESSOR: ANDRES ARRIETA
THESIS: MECHXELS: LEVERAGING BISTABLE STRUCTURES FOR COLOR CHANGE, CHARACTER, AND IMAGE DISPLAY

ZHIPENG (STEVEN) DENG
DEGREE: PH.D., 2021
PROFESSOR: QINGYAN (YAN) CHEN
THESIS: RECOGNITION OF BUILDING OCCUPANT BEHAVIORS FROM INDOOR ENVIRONMENT PARAMETERS BY DATA MINING APPROACH

VRUSHALI DESHMUKH
DEGREE: M.S., 2021
PROFESSOR: GREGORY M. SHAVER
THESIS: ALTERNATE FUELS FOR ON-ROAD ENGINES AND IMPACT ON REDUCING CARBON FOOTPRINT

MILES DROEGE
DEGREE: M.S., 2021
PROFESSOR: GREGORY M. SHAVER
THESIS: HEAVY-DUTY TRUCK PLATOONING ON HILLY TERRAIN: METHODS FOR ASSESSMENT AND IMPROVEMENT

CHISOM EMEGOAKOR
DEGREE: M.S., 2021
PROFESSOR: GREGORY M. SHAVER
THESIS: NON-THESIS
2021 - 2022 RECENT HERRICK LAB GRADUATES

ANDREW HAGEN
DEGREE: M.S., 2021
PROFESSORS: JEFFREY RHOADS / J. STUART BOLTON
THESIS: HIGH-FREQUENCY SOUND ABSORPTION CHARACTERIZATION OF MOCK ENERGETIC MATERIALS

SANG WOO HAM
DEGREE: PH.D., 2021
PROFESSOR: PANAGIOTA KARAVA
THESIS: ENERGY ANALYTICS FOR ECO-FEEDBACK DESIGN IN MULTI-FAMILY RESIDENTIAL BUILDINGS

JOHN HODUL
DEGREE: PH.D., 2022
PROFESSORS: JEFFREY RHOADS / BRYAN W. BOUDOURIS
THESIS: DEVELOPMENT OF SELECTIVELY INTERACTING SOFT MATERIALS FOR GAS SENSOR APPLICATIONS

YU-WEI HUNG
DEGREE: PH.D., 2021
PROFESSOR: TRAVIS HORTON
THESIS: SIMULATION AND OPTIMIZATION OF DESICCANT-BASED WHEEL INTEGRATED HVAC SYSTEMS

MYUNGWON HWANG
DEGREE: M.S., 2021
PROFESSOR: ANDRES ARRIETA
THESIS: NONLINEAR DYNAMICS IN LATTICES OF BISTABLE ELEMENTS

SUYASH JADHAV
DEGREE: M.S., 2021
PROFESSOR: PETER H. MECKL
THESIS: TRANSIENT MODELING OF TURBOCHARGER TURBINE USING PHYSICS AND MACHINE LEARNING TECHNIQUES

CHUFAN JIANG
DEGREE: PH.D., 2022
PROFESSOR: GREGORY M. SHAVER
THESIS: PERCEPTION SYSTEM DEVELOPMENT FOR AUTOMATED COMBINE-TO-CART UNLOADING DURING HARVEST OF GRAIN CROPS
2021 - 2022 RECENT HERRICK LAB GRADUATES

JUN HO KIM
DEGREE: M.S., 2021  PROFESSOR: BRANDON E. BOOR
THESIS: THE EFFECT OF FACEMASK TYPES ON THE INHALED DEPOSITED DOSE RATE OF PATHOGENIC BIOAEROSOLS IN MEDICAL FACILITIES

MICHAEL KIM
DEGREE: PH.D., 2021  PROFESSOR: ATHANASIOS (THANOS) TZEMPELIKOS
THESIS: LUMINANCE MONITORING AND DAYLIGHTING CONTROL IN BUILDINGS USING LOW-COST CAMERAS

PATRICK KRANE
DEGREE: PH.D., 2022  PROFESSORS: NEERA JAIN / AMY M. MARCONNET
THESIS: AN EXAMINATION OF METAL HYDRIDES AND PHASE-CHANGE MATERIALS FOR YEAR-ROUND VARIABLE-TEMPERATURE ENERGY STORAGE IN BUILDING HEATING AND COOLING SYSTEMS

ZILIN LI
DEGREE: M.S., 2021  PROFESSOR: NICOLE L. KEY
THESIS: NON-THESIS

ZIPING LIU
DEGREE: PH.D., 2021  PROFESSORS: GREGORY M. SHAVER / JOHN T. EVANS
THESIS: AUTOMATIC GRAIN UNLOADING FOR CROP HARVEST MACHINE

ALANA LUND
DEGREE: PH.D., 2021  PROFESSORS: SHIRLEY J. DYKE / ILIAS BILIONIS
THESIS: BAYESIAN IDENTIFICATION OF NONLINEAR STRUCTURAL SYSTEMS: INNOVATIONS TO ADDRESS PRACTICAL UNCERTAINTY

JOE MESEKE
DEGREE: M.S., 2022  PROFESSOR: JEFFREY RHOADS / GEORGE CHIU
THESIS: INTEGRATED ELECTRONIC INTERFACE DESIGN FOR CHEMIRESISTIVE AND RESONANT GAS SENSORS
<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Professors</th>
<th>Thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanessa Restrepo Perez</td>
<td>Ph.D., 2021</td>
<td>Eckhard A. Groll / Ramses Martinez</td>
<td>Bioinspired design and fabrication of sustainable construction materials with enhanced mechanical performance and self-healing properties</td>
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<tr>
<td>Trevor Petri</td>
<td>M.S., 2021</td>
<td>Jeffrey Rhoads</td>
<td>Characterization of mock plastic-bonded energetic materials under cyclic compression at low strain rates</td>
</tr>
<tr>
<td>Akshay Rao</td>
<td>M.S., 2021</td>
<td>David Warsinger</td>
<td>Uncovering the efficiency limits to obtaining water: on earth and beyond</td>
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<tr>
<td>Sree Harsha Rayasam</td>
<td>Ph.D., 2021</td>
<td>Gregory M. Shaver</td>
<td>Robust multiple-input multiple-output control of gas exchange processes in advanced internal combustion engines</td>
</tr>
<tr>
<td>Vatsal Shah</td>
<td>Ph.D., 2021</td>
<td>Eckhard A. Groll / James E. Braun</td>
<td>Oil management in systems running vapor compression cycle</td>
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<tr>
<td>Alan Shea</td>
<td>M.S., 2021</td>
<td>Wenbin Yu</td>
<td>Non-Thesis</td>
</tr>
<tr>
<td>Zachary Siefker</td>
<td>Ph.D., 2022</td>
<td>Jeffrey Rhoads / James E. Braun</td>
<td>Development and evaluation of carbon dioxide sensors for building applications</td>
</tr>
</tbody>
</table>
2021 - 2022 RECENT HERRICK LAB GRADUATES

TYLER SWEDES
DEGREE: M.S., 2021  PROFESSOR: GREGORY M. SHAVER
THESIS: ELECTRIFICATION OF DIESEL-BASED POWERTRAINS FOR HEAVY VEHICLES

JAROD THROCKMORTON
DEGREE: M.S., 2021  PROFESSOR: DAVID CAPPELLERI
THESIS: NON-THESIS

PRATIK WALIMBE
DEGREE: M.S., 2022  PROFESSOR: NICOLE L. KEY
THESIS: NON-THESIS

ZHIYANG WEN
DEGREE: M.S., 2021  PROFESSOR: J. STUART BOLTON
THESIS: NON-THESIS

KATHERINE WILLIAMS
DEGREE: M.S., 2021  PROFESSOR: NEERA JAIN
THESIS: COGNITIVE MODELING FOR HUMAN-AUTOMATION INTERACTION: A COMPUTATIONAL MODEL OF HUMAN TRUST AND SELF-CONFIDENCE

SOURABH DEEPAK YADAV
DEGREE: M.S., 2022  PROFESSOR: DAVIDE ZIVIANI / JAMES E. BRAUN
THESIS: DEVELOPMENT, DESIGN, AND CONSTRUCTION OF A HUMAN-BUILDING INTERACTIONS LABORATORY