MECHANICAL ENGINEERING, PHD

The doctoral program in the Department of Mechanical Engineering prepares students to perform independent research in areas of faculty expertise within the department. The PhD program in Mechanical Engineering is designed to train outstanding students for advanced work in industry, national labs, and academia through a combination of coursework and hands on research.

PhD students are mentored by faculty to become world-class researchers. The Department of Mechanical Engineering has a long history of excellence in graduate education. The department is consistently ranked in the top 20 in the United States for graduate programs in mechanical engineering. The department offers research opportunities in a large number of established and emerging research specializations. Broad research themes within the department include: advanced manufacturing, biomechanics, computational engineering and design, energy systems, fluid and solid mechanics, and robotics, controls and sensing. Excellent research facilities are available for specialized research within these broad areas for studies in: biomechanics, combustion, computational design, controls, cryogenics, dynamics and vibrations, fluid dynamics, fluid power, geometric modeling and prototyping, heat and mass transfer, internal combustion engines, laser diagnostics, manufacturing processes, mechanics, mechatronics, polymer and composites processing, powertrain control, robotics, solar energy, and more.

For a list of mechanical engineering faculty along with faculty research interests, please visit our faculty directory (https://directory.engr.wisc.edu/display.php/faculty/?page=me&search=faculty). For more information on research areas see our page on research in Mechanical Engineering (https://www.engr.wisc.edu/department/mechanical-engineering/research-in-mechanical-engineering/).

ADMISSIONS

ADMISSIONS

Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. ***Applicants must meet* the minimum requirements (https://grad.wisc.edu/apply/requirements/) *of the Graduate School as well as the program(s).*** Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply/).

Requirements	Detail
Fall Deadline	December 15
Spring Deadline	September 1
Summer Deadline	December 15
GRE (Graduate Record Examinations)	Not Required.*
English Proficiency Test	Every applicant whose native language is not English, or whose undergraduate instruction was not exclusively in English, must provide an English proficiency test score earned within two years of the anticipated term of enrollment. Refer to the Graduate School: Minimum Requirements for Admission policy: https://policy.wisc.edu/library/UW-1241 (https://policy.wisc.edu/library/UW-1241/).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3

* Submitted scores will not be used in admission decisions.

APPLICATION REQUIREMENTS AND PROCESS

Degree

Most applicants have a Bachelor of Science in Mechanical Engineering. Applicants with a Bachelor of Science in other engineering or physical and natural science disciplines will be considered for admission. International applicants must have a degree comparable to a regionally accredited US bachelor's degree.

GPA

The Department of Mechanical Engineering prefers a 3.2/4.0 GPA. The minimum GPA to be reviewed by the admission committee is 3.0/4.0.

Advisor Selection Process

Applicants must seek out and secure their own faculty advisor. International students must complete this process as part of the application process, before an offer of admission may be granted. To seek out a faculty advisor, review the department Research (https://engineering.wisc.edu/departments/mechanical-engineering/research/) and People (https://directory.engr.wisc.edu/me/faculty/) websites. Only those faculty listed with titles of Assistant Professor, Associate Professor, or Professor, can serve as graduate advisors. Do not contact Emeritus faculty, Lecturers, Research Scientists, or Faculty Associates. You are encouraged to inquire about possible funding opportunities. If a faculty member offers to be your advisor, ask them to email their acceptance to megradadmission@engr.wisc.edu.

Application Materials

Each application must include the following:

- Graduate School Application (https://grad.wisc.edu/apply/)
- Academic transcripts
- Statement of purpose
- Resume/CV
- Three letters of recommendation
- English Proficiency Score **(if required)**
- Application Fee

All applicants must satisfy requirements that are set forth by the Graduate School (https://grad.wisc.edu/). Admitted applicants without Mechanical Engineering Bachelor of Science degrees may be required to complete one or more courses in addition to degree requirements to satisfy any deficiencies (this requirement cannot be determined prior to admission).

Academic Transcript
Within the online application, upload the undergraduate transcript(s) and, if applicable, the previous graduate transcript. Unofficial copies of transcripts are required for review and official copies are required for admitted applicants. Do not send transcripts or any other application materials to the Graduate School or the Department of Mechanical Engineering unless requested. Review the requirements set by the Graduate School (https://grad.wisc.edu/apply/requirements/) for additional information about degrees/transcripts.

Statement of Purpose
In this document, applicants should explain why they want to pursue further education in Mechanical Engineering and discuss which UW faculty members they would be interested in doing research with during their graduate study (see the Graduate School for more advice on how to structure a personal statement (https://grad.wisc.edu/apply/prepare/)).

Resume
Upload your resume in your application.

Three Letters of Recommendation
These letters are required from people who can accurately judge the applicant's academic, research, and/or work performance. Letters of recommendation are submitted electronically to graduate programs through the online application. See the Graduate School for FAQs (https://grad.wisc.edu/apply/) regarding letters of recommendation. Letters of recommendation are due by the deadline listed above.

English Proficiency Score
Every applicant whose native language is not English, or whose undergraduate instruction was not in English, must provide an English proficiency test score. The UW-Madison Graduate School accepts TOEFL, IETLS, or Duolingo English Test scores. Your score will not be accepted if it is more than two years old from the start of your admission term. Country of citizenship does not exempt applicants from this requirement. Language of instruction at the college or university level and how recent the language instruction was taken are the determining factors in meeting this requirement.

International degree-seeking applicants must prove English proficiency using the Graduate School's requirements (https://grad.wisc.edu/apply/requirements/).

Application Fee
Submission must be accompanied by the one-time application fee. See the Graduate School for FAQs (https://grad.wisc.edu/apply/#FAQ) regarding fees.

Fee grants are available through the conditions outlined here by the Graduate School (https://grad.wisc.edu/apply/fee-grant/). Applicants who do not qualify for a fee grant as explained above, may seek out a Mechanical Engineering faculty advisor and discuss the fee grant option with that individual. If the faculty advisor is able and willing to pay the application fee for the applicant, the faculty advisor should contact the Mechanical Engineering Associate Chair for Graduate Studies or the Mechanical Engineering Graduate Admissions Team (megradadmission@engr.wisc.edu) for assistance.

REENTRY ADMISSIONS
If previously enrolled as a graduate student in the Department of Mechanical Engineering, have not earned the degree, but have had a break in enrollment for a minimum of a fall or spring term, applicants must re-apply to resume studies. Review the Graduate School requirements for previously enrolled students (https://policy.wisc.edu/library/UW-1230/). The previous faculty advisor (or another Mechanical Engineering faculty advisor) must be willing to supply advising support and should e-mail the Mechanical Engineering Graduate Student Services Coordinator regarding next steps in the process.

If previously enrolled in a UW-Madison graduate degree, completed that degree, have had a break in enrollment since earning the degree and would now like to apply for another UW-Madison program, applicants are required to submit a new student application through the UW-Madison Graduate School online application. For Mechanical Engineering graduate programs, you must follow the entire application process as described above.

CURRENTLY ENROLLED GRADUATE STUDENT ADMISSIONS
Students currently enrolled as a graduate student at UW-Madison, whether in Mechanical Engineering or a non-Mechanical Engineering graduate program, wishing to apply to this degree program should contact the Mechanical Engineering Graduate Admissions Team (megradadmission@engr.wisc.edu) to inquire about the process and deadlines several months in advance of the anticipated enrollment term. Current students may apply to change or add programs for any term (fall, spring, or summer).

QUESTIONS
If you have questions, contact megradadmission@engr.wisc.edu.

FUNDING

FUNDING
GRADUATE SCHOOL RESOURCES
Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding/) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

PROGRAM RESOURCES
There are three mechanisms for Graduate Student funding through the university for Mechanical Engineering PhD students:

1. Fellowships
2. Graduate assistantships: project assistantships, teaching assistantships, and research assistantships
3. Traineeships

Funding is awarded based on the qualifications of the student, the number of applicants, the amount of available funding, and the number of continuing students receiving support. You can apply for funding for research assistantships by contacting individual faculty members directly. Please check our website (https://directory.engr.wisc.edu/me/faculty/) to look for faculty (only those listed with titles of assistant professor, associate professor, or professor can serve as graduate student advisors). Search for faculty who have research interests (https://engineering.wisc.edu/departments/mechanical-engineering/research/) that align closely with your own by viewing faculty directory entries, visiting the faculty's website (linked from the directory page), and reviewing publications by the faculty member. Once you have identified faculty with interests close to your own, you are encouraged to contact them by email to inquire regarding available research assistant positions. The

admissions office does not know if a particular professor has research assistant positions available.

Students who apply to the department will be automatically considered for fellowship opportunities within the department. Admitted students will be eligible to apply for Teaching Assistantship positions. More information, including the application, will be available to students after admission is complete.

ADDITIONAL RESOURCES

Student Loans

Students who are U.S. citizens or permanent residents may be eligible to receive some level of funding through the federal direct loan program. Private loans may also be available. Learn more about financial aid at the Financial Aid website (https://financialaid.wisc.edu/).

International Student Services Funding and Scholarships

For information on International Student Funding and Scholarships visit the International Student Services website (https://iss.wisc.edu/students/new-students/funding-scholarships/).

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

Evening/Weekend: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

Requirement	Detail
Minimum Credit Requirement	60 credits
Minimum Residence Credit Requirement	32 credits
Minimum Graduate Coursework Requirement	30 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) Requirement Policy: https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/)
Overall Graduate GPA Requirement	3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/).
Other Grade Requirements	Students must earn a C or above in all formal coursework. PhD candidates may not have any more than two Incompletes on their record at any one time.
Assessments and Examinations	The PhD candidate will need to pass a qualifying exam, preliminary exam, and a final defense in order to obtain a degree.
Language Requirements	No language requirements.
Graduate School Breadth Requirement	All doctoral students are required to complete a doctoral minor or graduate/professional certificate. Refer to the Graduate School: Breadth Requirement in Doctoral Training policy: https://policy.wisc.edu/library/UW-1200 (https://policy.wisc.edu/library/UW-1200/).

REQUIRED COURSES

Two semesters of M E 903 Graduate Seminar are required. These should be taken the first two semesters the student is in residence. If an MS degree is received at UW–Madison, additional M E 903 credits are not required.

A minimum of 36 formal course credits beyond the BS degree are required. Formal credits are any course offering this is not a seminar course, thesis research course, or independent study course. This includes a minimum of 9 credits (usually three courses) numbered 700 or above. A minimum of 3 credits (usually one course) numbered 700 and above must be in Mechanical Engineering (M E (http://guide.wisc.edu/courses/m_e/)) and/or Engineering Mechanics (E M A (http://guide.wisc.edu/courses/e_m_a/)) taken at UW–Madison. A minimum of one (3 or more - credit) math course.

Math Course Options

The following courses would satisfy the math course requirement.

Code	Title	Credits
M E 601	Special Topics in Mechanical Engineering (Topic "Computational Math w/Engr Apps")	
M E 964	Special Advanced Topics in Mechanical Engineering (Topics: "App Comp Math w/ Eng Apps" OR "Comp Math with Apps in Eng" OR "Sci Computing for Apps in Eng")	

E M A/E P 476	Introduction to Scientific Computing for Engineering Physics
E M A/E P 547	Engineering Analysis I
E M A/E P 548	Engineering Analysis II
MATH 321	Applied Mathematical Analysis
MATH 322	Applied Mathematical Analysis
400 and above Math Department courses	
400 and above Statistics Department courses	
Graduate "transfer credits" equivalent to the above	

Acceptable courses for the remainder of the required 36 formal course credits (this total includes the courses taken for the PhD breadth requirement) are those numbered 400 and above.

Minimum of 18 thesis credits (M E 790 Master's Research and Thesis, M E 890 PhD Research and Thesis, M E 990 Dissertator Research and Thesis) are required with an overall grade of S.

POLICIES

GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy/) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

PRIOR COURSEWORK

Graduate Credits Earned at Other Institutions

With faculty advisor and Department of Mechanical Engineering Graduate Committee approval, students are allowed to transfer up to 28 credits of graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. Coursework earned ten years or more prior to admission is not allowed to satisfy requirements.

Undergraduate Credits Earned at Other Institutions or UW-Madison

- **Undergraduate credits from UW-Madison:** With faculty advisor and Department of Mechanical Engineering Graduate Committee approval, a maximum of 7 credits from a UW-Madison undergraduate degree may be eligible to be applied toward the minimum graduate degree credit requirement. Only coursework that is applicable to the degree curriculum is eligible. These credits are not allowed to count toward the minimum graduate coursework (50%) requirement unless taken in courses numbered 700 or above. No credits can be counted toward the minimum graduate residence credit requirement. Coursework earned ten years or more prior to admission is not allowed to satisfy requirements.
- **Undergraduate credits from other institutions:** Undergraduate credits from other institutions are not permitted to be used in this degree.

Credits Earned as a Professional Student at UW-Madison (Law, Medicine, Pharmacy, and Veterinary careers)

Refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy.

Credits Earned as a University Special Student at UW–Madison

With faculty advisor and Department of Mechanical Engineering Graduate Committee approval, refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy.

PROBATION

The Department of Mechanical Engineering Graduate Committee academic progress policy may be reviewed in the Graduate Handbook (see Contact box for link).

ADVISOR / COMMITTEE

All students must have a mechanical engineering faculty advisor who assists them in planning a course sequence that meets degree requirements, who helps guide them and mentor them in their research, and who will discuss career objectives with the student.

A qualifying exam committee must include the student's mechanical engineering faculty advisor and two other mechanical engineering faculty members.

A preliminary exam committee must include the student's mechanical engineering faculty advisor and at least three other members who will also serve on the final oral defense committee.

A final dissertation oral exam (defense) must be presented to the dissertation committee of at least five members (but no more than eight) consisting of your advisor, who chairs the committee, three other graduate faculty or former graduate faculty up to one year after resignation or retirement, and one of the following: another graduate faculty, a retired faculty member with emeritus status, or a UW–Madison academic staff member who has been approved by the Mechanical Engineering executive committee. At least one faculty member on the committee must be from outside the Mechanical Engineering Department. Members of the committee from outside of Mechanical Engineering should be selected to have a background appropriate to evaluate the dissertation.

CREDITS PER TERM ALLOWED

15 credits

TIME LIMITS

Qualifying Exam

The written portion of the qualifying exam is offered twice a year, once in August/September and once in January, generally the week before classes start. The associated literature review presentation must be completed within the timing limits stated (see graduate handbook, contact box).

1. If you enter the PhD program directly without an MS or equivalent degree, you will first earn 30 graduate credits. Take your qualifying exam either the first or second time that it is offered after the semester in which you earn those 30 credits.
2. If you earn a UW–Madison Mechanical Engineering MS and immediately enter the PhD program in the following semester, take your qualifying exam either the first or second time it is offered after the semester in which you earned your MS.

3. If you enter the PhD program with an MS degree either from another department or institution or are returning to UW–Madison with an MS degree after an absence, take the exam at the start of your third PhD semester.

Preliminary Exam

PhD students must complete their preliminary exam within five years of passing their qualifying exam.

Dissertation Defense (Oral Thesis Presentation)

There must be at least nine (9) months between the preliminary exam and dissertation defense.

A candidate for a doctoral degree who fails to successfully complete the dissertation defense and deposit the dissertation within five years after passing the preliminary examination may be required to take another preliminary examination to be admitted to candidacy a second time.

Average Time to Degree

The average time to degree, beyond the bachelor degree, is 5 years.

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (https://doso.students.wisc.edu/bias-or-hate-reporting/)
- Graduate Assistantship Policies and Procedures (https://hr.wisc.edu/policies/gapp/#grievance-procedure)
- Hostile and Intimidating Behavior Policies and Procedures (https://hr.wisc.edu/hib/)
  - Office of the Provost for Faculty and Staff Affairs (https://facstaff.provost.wisc.edu/)
- Employee Assistance (http://www.eao.wisc.edu/) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (https://employeedisabilities.wisc.edu/) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (https://grad.wisc.edu/) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (https://compliance.wisc.edu/) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office Student Assistance and Support (OSAS) (https://osas.wisc.edu/) (for all students to seek grievance assistance and support)
- Office of Student Conduct and Community Standards (https://conduct.students.wisc.edu/) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (http://www.ombuds.wisc.edu/) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (https://compliance.wisc.edu/titleix/) (for concerns about discrimination)

Mechanical Engineering Grievance Procedures

If a student feels unfairly treated or aggrieved by faculty, staff, or another student, the University offers several avenues to resolve the grievance. Students' concerns about unfair treatment are best handled directly with the person responsible for the objectionable action. If the student is uncomfortable making direct contact with the individual(s) involved, they should contact the advisor or the person in charge of the unit where the action occurred (program or department chair, section chair, lab manager, etc.). Many departments and schools/colleges have established specific procedures for handling such situations; check their web pages and published handbooks for information. If such procedures exist at the local level, these should be investigated first. For more information see the Graduate School Academic Policies & Procedures: https://grad.wisc.edu/acadpolicy/?policy=grievancesandappeals. The Assistant Dean for Graduate Affairs (engr-dean-graduateaffairs@engr.wisc.edu) provides overall leadership for graduate education in the College of Engineering (CoE), and is a point of contact for graduate students who have concerns about education, mentoring, research, or other difficulties.

1. The student is encouraged to speak first with the person toward whom the grievance is directed to see if a situation can be resolved at this level.

2. Should a satisfactory resolution not be achieved, the student should contact the Associate Chair for Graduate Studies or the John Bollinger Chair of Mechanical Engineering (https://engineering.wisc.edu/departments/mechanical-engineering/people/) to discuss the grievance. The Associate Chair for Graduate Studies or Department Chair will facilitate problem resolution through informal channels and facilitate any complaints or issues of students. The first attempt is to help students informally address the grievance prior to any formal complaint. Students are also encouraged to talk with their faculty advisors regarding concerns or difficulties if necessary. University resources for sexual harassment, discrimination, disability accommodations, and other related concerns can be found on the UW Office of Compliance website (https://compliance.wisc.edu/). Other campus resources can be found above.

3. If the issue is not resolved to the student's satisfaction the student can submit the grievance to the Associate Chair for Graduate Studies in writing, within 60 calendar days of the alleged unfair treatment.

4. On receipt of a written complaint, a faculty committee will be convened by the Associate Chair for Graduate Studies to manage the grievance. The faculty committee will obtain a written response from the person toward whom the complaint is directed. This response will be shared with the person filing the grievance.

5. The faculty committee will determine a decision regarding the grievance. The Associate Chair for Graduate Studies will report on the action taken by the committee in writing to both the student and the party toward whom the complaint was directed within 15 working days from the date the complaint was received.

6. At this point, if either party (the student or the person toward whom the grievance is directed) is unsatisfied with the decision of the faculty committee, the party may file a written appeal. Either party has 10 working days to file a written appeal to the School/College.

7. Documentation of the grievance will be stored for at least 7 years. Significant grievances that set a precedent will be stored indefinitely.

The Graduate School has procedures for students wishing to appeal a grievance decision made at the school/college level. These policies are described in the Graduate School's Academic Policies & Procedures: https://grad.wisc.edu/acadpolicy/?policy=grievancesandappeals.

OTHER

n/a

PROFESSIONAL DEVELOPMENT

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (https://grad.wisc.edu/pd/) to build skills, thrive academically, and launch your career.

LEARNING OUTCOMES

LEARNING OUTCOMES

1. Demonstrate an extraordinary, deep understanding of mathematical, scientific, and engineering principles in the field.
2. Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems.
3. Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems.
4. Recognize and apply principles of ethical and professional conduct.
5. Demonstrate an ability to synthesize knowledge from a subset of the biological, physical, and/or social sciences to help frame problems critical to the future of their discipline.
6. Demonstrate an ability to conduct original research and communicate it to their peers.

PEOPLE

PEOPLE

PROFESSORS

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Darryl Thelen (Chair)
Peter Adamczyk
Mark Anderson
Riccardo Bonazza
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Curt Bronkhorst
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Wendy Crone
Christian Franck
Jaal Ghandhi
Sage Kokjohn
Dan Negrut
Gregory F. Nellis
Frank Pfefferkorn
Xiaoping Qian
Douglas Reindl
David Rothamer
Scott T. Sanders
Krishnan Suresh
Mario F. Trujillo
Lih-sheng Turng
Fabian Waleffe
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ASSOCIATE PROFESSORS

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Lianyi Chen
Melih Eriten
Katherine Fu
Tom N. Krupenkin
Ying Li
Franklin Miller
Sangkee Min
Wenxiao Pan
James Pikul
Pavana Prabhakar
Alejandro Roldan-Alzate
Michael Zinn
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ASSISTANT PROFESSORS

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Yunus Alapan
Joseph Andrews
Jennifer Franck
Corinne Henak
Eric Kazyak
Xiao Kuang
Allison Mahvi
Luca Mastropasqua
Jacob Notbohm
Josh Roth
Shiva Rudraraju
Eric Tervo
Ramathasan Thevamaran
Dakotah Thompson
Michael Wagner
Wei Wang
Jinlong Wu
Xiaobin Xiong
Xiangru Xu
Lei Zhou
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See also Mechanical Engineering Faculty Directory (https://directory.engr.wisc.edu/me/faculty/).