MECHANICAL ENGINEERING, PH.D.

The doctoral program in the Department of Mechanical Engineering prepares students to perform independent research in areas of faculty expertise within the department. The Ph.D. 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.

Ph.D. 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: biomechanics, computational engineering, energy, manufacturing, and mechanics and controls. 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

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/).

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
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<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 15</td>
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<tr>
<td>Spring Deadline</td>
<td>October 1</td>
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<tr>
<td>Summer Deadline</td>
<td>December 15</td>
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<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Required.*</td>
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</tbody>
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English Proficiency Test
Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (https://grad.wisc.edu/apply/requirements/#english-proficiency).

Other Test(s) (e.g., GMAT, MCAT) | n/a
Letters of Recommendation Required | 3

*Due to COVID-19, GRE scores will not be required for applications to Mechanical Engineering graduate programs for admission to the Spring 2023, Summer 2023, and Fall 2023 terms.

APPLICATION REQUIREMENTS and PROCESS

Degree: Most applicants have a Bachelor of Science in Mechanical Engineering. Students 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 U.S. 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.

GRE: The GRE requirement is waived for applications to the Spring 2023, Summer 2023, and Fall 2023 terms. Any scores submitted will not be reviewed.

Advisor selection process: Applicants are required to 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 please review the department Research (https://www.engr.wisc.edu/department/mechanical-engineering/research-in-mechanical-engineering/) 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 meggradationmission@engr.wisc.edu.

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/). Upon acceptance, students 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).
DEADLINES
To apply to the Mechanical Engineering program, complete applications (https://grad.wisc.edu/apply/), including supportive materials, must be submitted as described below and received by the following deadline dates:

- Fall Semester—December 15
- Spring Semester—October 1
- Summer Session—December 15

ACADEMIC TRANSCRIPT
Electronically submit one copy of your transcript of all undergraduate and previous graduate work along with your online application to the Graduate School. Unofficial copies of transcripts will be accepted for review, but official copies are required for admitted students. Please do not send transcripts or any other application materials to the Graduate School or the Mechanical Engineering department unless requested. Please 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.

GRE SCORES
The GRE requirement is waived for applications to the Spring 2023, Summer 2023, and Fall 2023 terms. Any scores submitted will not be reviewed.

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 or IELTS 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.

For more information regarding minimum score requirements and exemption policy, please see the Graduate School Requirements for Admission (https://grad.wisc.edu/apply/requirements/).

APPLICATION FEE
Submission must be accompanied by the one-time application fee. It is non-refundable and can be paid by credit card (Master Card or Visa) or debit/ATM. Information about the application fee may be found here (https://grad.wisc.edu/apply/) (scroll to the ‘Frequently asked questions’).

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 ME Associate Chair for Graduate Studies or the ME Graduate Admissions Team (megradadmission@engr.wisc.edu) for assistance.

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

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

If you were 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; you are required to submit a new student application through the UW-Madison Graduate School online application. For ME 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 ME or a non-ME graduate program, wishing to apply to this degree program should contact the ME 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, please contact megradadmission@engr.wisc.edu.

FUNDING
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 Ph.D. 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 (http://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 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

FEDERAL 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. These loans are available to qualified graduate students who are taking at least 4 credits during the fall and spring semesters, and 2 credits during summer. Private loans are also available. Learn more about financial aid at their website (https://financialaid.wisc.edu/).

INTERNATIONAL STUDENT SERVICES FUNDING AND SCHOLARSHIPS
For information on International Student Funding and Scholarships visit the ISS 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

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Mode of Instruction Definitions
Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students are able to complete a program with minimal disruptions to careers and other commitments.

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

Requirements 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%) policy (https://policy.wisc.edu/library/UW-1244/).
Overall Graduate GPA Requirement 3.25 GPA required.
Other Grade Requirements Students must earn a C or above in all formal coursework. Ph.D. candidates may not have any more than two Incompletes on their record at any one time.
Assessments and Examinations The Ph.D. candidate will need to pass a qualifying exam, preliminary exam, and a final defense in order to obtain a degree.
Language Requirement No language requirements.
Minimum of 18 thesis credits (M E 790 Master’s Research and Thesis, M E 890 Ph D 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 Work from Other Institutions

With program approval, students are allowed to count up to 24 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 to a doctoral degree is not allowed to satisfy requirements.

#### UW–Madison Undergraduate

Up to 7 credits numbered 400 or above can be counted toward the minimum graduate degree credit requirement. These credits may be counted toward the minimum graduate coursework (50%) requirement if they are from courses numbered 700 or above. No credits can be counted toward the minimum graduate residence credit requirement. A course at the 300 level can only be transferred from a UW-Madison undergraduate program if it was taken as a technical elective (i.e., non-required course). Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

#### UW–Madison University Special

With program approval, and payment of the difference in tuition, students are allowed to count up to 15 credits of coursework numbered 400 or above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement and the minimum graduate degree credit requirement. These credits may be counted toward the minimum graduate coursework (50%) requirement if they are in courses numbered 700 or above. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

### Probation

This program follows the Graduate School’s Probation policy (https://policy.wisc.edu/library/UW-1217/), except that a semester GPA below 3.25 will result in the student being placed on academic probation. If a semester GPA of 3.25 is not attained during the subsequent semester of full time enrollment (or 12 credits of enrollment if enrolled part-time), this will be deemed unsatisfactory progress and the student may be dismissed from the program or allowed to continue for one additional semester based on advisor appeal to the department.

### 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 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 oral defense committee must include the student's mechanical engineering faculty advisor and at least four other members, 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 research scientist with principal investigator status who has been approved by the ME executive committee. At least one faculty member on the committee must be from outside of the ME department.

CREDITS PER TERM ALLOWED
15 credits

TIME LIMITS
Students entering the PhD program without an MS or equivalent degree must take the qualifying exam no later than the second time it is offered after completion of 30 graduate credits regardless of whether the student chooses to complete an MS degree. Students completing 30 graduate credits in the fall semester must take the qualifying exam no later than the following August, and students completing 30 graduate credits in the spring semester or summer sessions must take the qualifying exam no later than the following January.

Students entering the PhD program immediately after earning an MS degree in Mechanical Engineering from UW–Madison must take the qualifying exam no later than the second time it is offered after completing their MS degree. Students graduating in the fall semester must take the qualifying exam no later than the following August, and students graduating in the spring or summer semesters must take the qualifying exam no later than the following January.

Students entering the PhD program with an MS degree either from another department or institution, or who are returning to UW-Madison with an MS degree after an absence, must take the qualifying exam before the start of their third semester, allowing students two full semesters (fall/spring) of classes before taking the exam. Students entering in the program in the summer session or fall semester need to take the qualifying exam no later than the following August, and students entering in the program in the spring semester need to take the qualifying exam no later than the following January.

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

The preliminary exam must be passed at least 9 months prior to the thesis defense.

A candidate for a doctoral degree who fails to take the final oral examination 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.

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/)
- Dean of Students Office (https://doso.students.wisc.edu/) (for all students to seek grievance assistance and support)
- 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 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 Graduate Committee Chair 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 Graduate Committee Chair 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 Graduate Committee Chair 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 Graduate Committee Chair 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

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

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.

OTHER
n/a

PEOPLE

PROFESSORS
Darryl Thelen (Chair)
Christian Franck
Jaal Ghandhi
Dan Negruit
Gregory F. Nellis
Tim Osswald
Frank Pfefferkorn
John Pfotenhauer
Xiaoping Qian
Douglas Reindl
David Rothamer
Scott T. Sanders
Krishnan Suresh
Lih-sheng Turng

ASSOCIATE PROFESSORS
Peter Adamczyk
Mark Anderson
Melih Eriten
Katherine Fu
Sage Kokjohn
Tom N. Krupenkin
Franklin Miller
Sangkee Min
Mario F. Trujillo
Michael Zinn

ASSISTANT PROFESSORS
Joseph Andrews
Lianyi Chen
Corinne Henak
Wenxiao Pan
Pavana Prabhakar
Alejandro Roldan-Alzate
Josh Roth
Shiva Rudraraju
Stephan Rudykh
Dakota Thompson
Mike Wagner
Michael Wehner
Xiangru Xu

LECTURERS AND TEACHING FACULTY/PROFESSORS
Arganthael Berson
Glenn Bower
Michael Cheadle
Michael De Cicco
Kristofer Dressler
Randy Jackson
Andrew Mikkelson
Jason Oakley
Erick L. Oberstar
Jeffrey Roessler

See also Mechanical Engineering Faculty Directory (https://directory.engr.wisc.edu/me/faculty/).