

720-417-1
Mechanics of Continua, I
Fall, 2022 - 2023

Instructor: J. W. Rudnicki (A128, 491-3411, John.Rudnicki@gmail.com but try to use the discussion board – see below – as much as possible for class related matters)

Classroom: Tech MG28, 10 – 10:50 am

Office Hours: W 1:30 – 3:30, Th 3 -5 (best to call, email or let me know in class). You can always contact me via [campuswire](#), or before or after class to arrange a time for meeting.

Class information is posted on the **Canvas** Web Site. Announcements, examples of old exams and other information will be posted here.

Text: *Fundamentals of Continuum Mechanics*, John W. Rudnicki, John Wiley & Sons, Ltd., 2015.

Amazon (pbk): \$64.06

Wiley (pbk): \$96.95

Wiley (e-book): \$78.00

JWR: \$56.06 (Zelle or Venmo: email me).

Homework: Homework will generally be due on Fridays. Specific problems will be listed on Canvas. Homework should be clear and neat. It is your responsibility to make clear what you are doing.

After the graded homework is returned, you will have the opportunity to correct your mistakes and resubmit the corrections when the next homework is due. Clearly indicate that it is a resubmission, but you do not need to resubmit the entire homework, only the portions you are correcting. You do need to include the portions of the original homework showing what you did wrong. Corrections can be made on a separate piece of paper or on the original homework if they are clearly marked.

Grader: Yifan Yang, <mailto:yifan.yang@northwestern.edu> . If you have questions about grading the homework, you can contact Yifan, but he is not a TA. Do not contact him with questions about the course content or how to do the homework.

Grading: Homework (50%), Midterm (20%); Final Exam (30%).

Exams: Closed Book and notes.

Midterm Exam, Friday, October 21.

Final Examination. Wednesday, December 7, 3-5 pm.

Last update: September 15, 2022

Discussion Board: We will be using campuswire (<https://campuswire.com/c/G7DE87846/feed>) as a discussion board. Use the discussion board rather than emailing me. If you do email me, I will just tell you to post it on the discussion board. If you have something private to send me, you can do that via Campuswire. Post questions about homework, lectures, or anything related to Continuum Mechanics. If you have the same question, comment, or suggestion as someone else, post it. If you know, or think you know, the answer, post it. One of the best ways to learn material is to try to explain it to someone else. You can also post comments about the course (not abusive, please). I will monitor the board frequently but refrain from answering questions immediately to give others a chance to post solutions. This is a way for everyone to benefit and to learn from your classmates by asking and answering questions. Although I have taught this course for many years, I still learn from questions students ask. And I participate in several software forums that I find tremendously useful. This can be a great resource and a way to interact with your classmates.

Course Objectives

1. Basic understanding of tensors and tensor calculus in Cartesian coordinate systems and in coordinate-free form.
2. Understanding of stress as a tensor.
3. Understand the difference between material and spatial descriptions of motion.
4. Understanding the measures of strain and deformation and deformation rate for arbitrary deformation magnitudes.
5. Formulation of equations describing balance of mass, momentum and energy in their various forms.
6. Introduction to constitutive behavior.

After completing the course you should

1. Be familiar with and able to use index notation for vectors and tensors.
2. Be able to calculate components of tensors in different Cartesian coordinate systems.
3. Be able to use and manipulate the stress tensor and explain the meaning of its components.
4. Be able to manipulate and describe the relations among different measures of strain and deformation.
5. Be able to derive and explain equations describing balance of mass, momentum and energy.
6. Be able to read and understand papers and texts on advanced continuum mechanics.
7. Be able to formulate boundary value problems in continuum mechanics.

"Many difficulties are encountered when men treat hard things as though they were easy. Therefore, the sage, by treating easy things as though they were difficult, ends by finding nothing difficult."

Last update: September 15, 2022

Tao Te Ching

Academic Integrity

Giving or receiving aid on an exam is a violation of academic integrity. If discovered you will receive a zero for the exam. Cheating on an exam may be a short term gain but compromising your integrity is a lifelong failure.

Unauthorized student recording of classroom or other academic activities is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact [Accessible NU](#). Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University’s **Copyright Policy**, faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

“Uploading materials from this course to websites that sell such content to students is prohibited by Northwestern’s academic integrity policies, and may also put you at risk for violating copyright policies in Northwestern’s Student Code.”

A full explanation of McCormick policies on academic integrity is available at <http://www.mccormick.northwestern.edu/students/undergraduate/academic-integrity.html>

Other Resources

Accessible NU

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university’s established accommodation process (e: accessiblenu@northwestern.edu ; p: 847-467-5530). If you already have established accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

The Office of Equity promotes and participates in University initiatives to maintain an environment free of discrimination, harassment and sexual misconduct.

<https://www.northwestern.edu/equity/about/mission/index.html>

Last update: September 15, 2022

Counseling and Psychological Services (CAPS) serves as the primary mental health service at Northwestern University with offices on both the Evanston and Chicago campuses. CAPS provides a set of core services, including clinical services, educational workshops, and consultation with faculty, staff, and parents.

<https://www.northwestern.edu/counseling/>