GEORGIA INSTITUTE OF TECHNOLOGY
WOODRUFF SCHOOL OF MECHANICAL ENGINEERING
SPRING, 2024

June 02, 2023

The Syllabus may change slightly at the beginning of the semester and will be posted on canvas

ME 6452 WAVE PROPAGATION IN SOLIDS, at GT-Europe

Instructor: **Prof. Nico F. DECLERCQ**
Availability: After class + Open door policy (it may be useful to make an appointment by email however, Office: GT-E 224).
Email: declercq@gatech.edu

Course objectives:
Apart from the project mentioned below, the regular classes will cover material offering insight into mechanical wave propagation in solids. The goal is to introduce the fundamental principles governing wave motions in solids. Students will be exposed to the governing equations of wave motion and the physical background and interpretations, to techniques of solving these equations, as well as the applications of ultrasonics to quantitative nondestructive evaluation in simple and more complicated solid materials. There is a significant focus on the physical understanding of the different phenomena studied in class.

Textbook: everything will be written on the white board and, if necessary, handouts will be given of PowerPoint presentations or else.

Reference Textbooks (Available in the Georgia Tech Library):

J.D. Achenbach, “Wave Propagation in Elastic Solids”, North-Holland, 1973.
B.A. Auld, "Acoustic fields and waves in solids", second edition. volume 1 and volume 2, Krieger Publishing Company, Malabar, Florida, 1990
Adnan H. Nayfeh, "Wave propagation in layered anisotropic media, with applications to composites", North Holland series in Applied Mathematics and Mechanics, 1995
A. Bedford and D.S. Drumheller, “Introduction to Elastic Wave Propagation”, Wiley, 1994.
J. Miklowitz, The Theory of Elastic Waves and Waveguides, North-Holland, 1978.
J. Rose, Ultrasonic Waves in Solid Media, Cambridge, 1999
K.F. Graff, Wave Motion in Elastic Solids, Dover, 1975

Brief Outline (details will be posted on canvas to help you structure your knowledge before the exams):

I. ISOTROPIC MEDIA
II. INHOMOGENEOUS WAVES
III. BOUNDED MEDIA PART 1
IV. SOUND IN ANISOTROPIC SOLIDS part 1
V. BOUNDED MEDIA PART 2
VI. SOUND IN ANISOTROPIC SOLIDS part 2
VII. BOUNDED MEDIA PART 3
VIII. GUIDED WAVES – HARMONIC WAVES IN WAVEGUIDES
IX. TOPICS COVERED BY PROJECTS

REQUIRED SILENCE IN CLASS : Class-participation (being present, paying attention, asking questions, …) is perfect. What is not OK is "noise". Therefore, be silent so that your classmates can listen to their teacher without being distracted.

GT Academic Honor Code

Students are required to follow the Georgia Tech honor code which may be found at: https://policylibrary.gatech.edu/student-life/academic-honor-code
Students are allowed to collaborate on out of class assignments but must include specific attribution to any help they received. Work turned in must be your own work not copied from anywhere else (including solution manuals) and you must state what type of assistance you received while completing the assignment.

CANVAS
Your instructor uses CANVAS to send you messages and your results of homework and quizzes. You are requested to submit your work through canvas.

Tasks and Grading weights:

Homework:	As needed.
Quiz 1:	around 1/3 of the semester (closed book, closed notes)
Quiz 2:	around 2/3 of the semester (closed book, closed notes)
Final Exam:	designated final exam week (open book, open notes)
Project:	Presentation when you are ready but before exams week / report should be submitted before the final exam week.
WEIGHTS:	= Homework ×5% + Quiz 1 ×25% + Quiz 2 ×25% + Final Exam ×30% + Final Project x15%

Grading policy:

For each exam, you will receive a numerical grade on canvas. These numbers must be interpreted as :
90%-100% : A
80%-89.99%: B
70%-79.99%: C
60%-69.99%: D
below 60% : F

Homework is graded as follows : full marks if correct, 0 if not correct, 50% if you give an answer but the answer is not correct.

Final Project grading: 50% on your report and 50% on your presentation. For each part, 50% reflects the quality of your presentation and the other 50% how interestingly you conveyed the information to your fellow students. It is important that your presentation is at a level that can be understood by your colleague students and at a level high enough to respect the intelligence of your classmates. The grade is given with cut-off values similar to the exams. Aim for a professionally looking report and presentation slides. Make your work interesting to your peers. It is highly discouraged to read notes during your presentation.
You are supposed to bring your own laptop with the presentation on it. You may also use the laptop of a colleague. If the class system is operational, then a pdf on a memkey may also work.

Note: if canvas estimates your final mark you need to ignore it because to calculate the final mark you need to use the proper weights as give earlier in this syllabus

Attendance at lectures is required, except if covid-19 issues prevent you from attending, as per the GT-Europe policy.

Office Hours : Feel free to ask questions just after class, or to stop by my office, or if you want to, you can also make an appointment by email. If you have a minor question that can be answered by email, you may also ask by email.

Student projects: you have to study a topic and deliver a **report** : word document, 7-10 A4 pages per student (single space, letter size 12 - This may include figures but not more than necessary and not larger than needed), written in your own words and not directly copied from anywhere else (add a reference list so you can list what information you got from which source); and you have to make a **presentation** at the END OF the semester (or earlier if you want to). The report, together with the PPT or PDF of your presentation should be submitted by email not later than finals week, but preferably before the reading period.

Projects and presentations can be made alone or in groups not larger than 3 students (an exception is possible, if motivated). Each student must speak 25 minutes. In case of groups: the purpose is to reach an equal level for all students of the group, therefore speakers can switch several times during the entire presentation so that we do not end up with one student making the easy intro and another student making the most difficult part of the presentation.

Your presentation may include movies, if needed, to convey your idea, however such movies cannot take any longer than 10% of the duration of your presentation.
Your presentation must be professional, at a level of your colleagues and above all 'interesting', 'scientific', and somewhat 'intellectually entertaining'. It is very important to be able to explain your topic or problem in a comprehensive way.

Project Grading: see above

TOPIC: the topic must be substantially related to this class and may cover chapters of textbooks on waves in solids, or a subject that you find interesting in the field of mechanical waves in solids. A list of examples will be distributed on canvas during the semester, the list will not be limited, therefore you may propose other topics by email.

END OF SYLLABUS