Acoustics

ECTS: 6 ECTS

COORDINATOR: Luis Hervella Nieto (luis.hervella@udc.es)

UNIVERSITY WHERE THE COORDINATOR IS: UDC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 1: Andrés Prieto Aneiros (andres.prieto@udc.es)

UNIVERSITY WHERE THE LECTURER 1 IS: UDC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No (tutorial videos are available at the virtual platform used for the course)

SUBJECT CONTENTS

Lesson 1. Modelling.

- 1.1. Introduction. Harmonic oscillator.
- 1.2. Basic elements of Algebra, Vector and Tensor Calculus.
- 1.3. Kinematics.
- 1.4. Mass and momentum.
- 1.5. Constitutive laws.
- 1.6. Lineal models.
- 1.7. Vibrations in continuum media.
- 1.8. Elements of structural acoustics (vibro-acoustics).

Lesson 2. Acoustic propagations in one dimension.

- 2.1. One-dimensional models

2.2. Wave equation in 1D.

2.3. Harmonic regime.

2.4. Coupling boundary conditions. Thin layer models.

2.5. Time-harmonic wave propagation in a multilayered.

Lesson 3. Elements of applied acoustics

3.1. Sound thresholds. Decibels. Pressure, intensity, and power levels

3.2. Reflection. Absorption and transmission coefficients.

3.3 Total absorption and surface or volume averages.

Lesson 4. Acoustic propagation in three dimensions.

4.1. Three-dimensional wave equation

4.2. Time-harmonic solutions. Three-dimensional Helmholtz equation.

Lesson 5. Numerical solutions.

5.1. Helmholtz problems in bounded domains.

5.2. Structural-acoustic problems

5.3. Helmholtz problems in bounded domains.

METHODOLOGY

1.- Lecture sessions: Lectures will be taught by a video-conference system in A Coruña, Santiago, Vigo and Madrid. The course teachers will explain the contents of the course using slides and lecture notes. Students will be highly encouraged to ask about any topic explained during the lectures.

2.- Final exam: Once the lecture period is over, a writing exam will be scheduled, where students will solve questions and problems with the help of books (including those in the course bibliography) or their own lecture notes. In this test students should demonstrate the knowledge acquired during the course.

3.- Assignments: During this course, some exercises and problems related to the course contents will be assigned. They will have to be solved and submitted taking into account a prescribed deadline.

LANGUAGE USED IN CLASS: it will depend on the audience

IS IT COMPULSORY TO ATTEND CLASS? Students can attend via conference system

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BIBLIOGRAPHY

M.E. Gurtin (1981). An Introduction to Continuum Mechanics. Academic Press, San Diego

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F. Ihlenburg (1998). Finite Element Analysis of Acoustic Scattering. Springer-Verlag, Berlin

H.J.-P. Morand, R. Ohayon (1995). Fluid-Structure Interaction. John Wiley & Sons, New York

D.T. Blackstock (2000). Fundamentals of Physical Acoustics. John Wiley & Sons, New York

R. Dautray, J.L. Lions (1990). Mathematical Analysis and Numerical Methods for Science and Technology. Springer-Verlag, Berlin

F. Fahy (1994). Sound and Structural Vibration: Radiation, Transmission and Response. Academic Press, London

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SKILLS

Basic:

CG1: To have knowledge that provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context, knowing how to translate industrial needs in terms of R & D in the field of mathematics Industrial.

CG2: To be able to apply the acquired knowledge and abilities to solve problems in new or unfamiliar environments within broader contexts, including the ability to integrate multidisciplinary R & D in the business environment.

CG4: To have the ability to communicate the findings to specialist and non-specialist audiences in a clear and unambiguous way.

CG5: To have the appropriate learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous, and also to be able to successfully undertake doctoral studies.

Specific:

CE1: To acquire a basic knowledge in an area of Engineering / Applied Science, as a starting point for an adequate mathematical modelling, using well-established contexts or in new or unfamiliar environments within broader and multidisciplinary contexts.

CE2: To model specific ingredients and make appropriate simplifications in the model to facilitate their numerical treatment, maintaining the degree of accuracy, according to previous requirements.

CE5: To be able to validate and interpret the results, comparing them with visualizations, experimental measurements and functional requirements of the physical engineering system.

Modelling specialization:

CM1: To be able to extract, using different analytical techniques, both qualitative and quantitative models.

WILL YOU BE USING A VIRTUAL PLATFORM?. Yes, the Moodle platform (moodle.udc.es)

WILL YOU BE USING ANY SPECIFIC SOFTWARE? No, however it could be occasionally required the use of programming tools and symbolic calculus packages such as Octave or Python.

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

Lecture sessions (20%): It will be taken into account the active attendance to the lecture sessions, and the student involvement during the lecture recitations.

Final exam (50%): The writing exam will include all the topics studied in this course. It will be allowed the use of books (included in the course bibliography) or student lecture notes.

Assignments (30%): During the lecture period, some exercises and problems will be assigned to the students. These assignments should be completed individually and submitted before the final exam takes place.

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Lecture sessions (20%): It will be taken into account the active attendance to the lecture sessions, and the student involvement during the lecture recitations.

Final exam (50%): The writing exam will include all the topics studied in this course. It will be allowed the use of books (included in the course bibliography) or student lecture notes.

Assignments (30%): During the lecture period, some exercises and problems will be assigned to the students. These assignments should be completed individually and submitted before the final exam takes place. For those students which were using this second opportunity, the deadline for the submission of their assignments will be the final exam date of the second opportunity. If the assignments would not be submitted in this second period, only the assignments submitted in the period of the first opportunity would be evaluated.
