

## Professional Software in Acoustics

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ECTS: 6 ECTS

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COORDINATOR: Duarte Santamarina Ríos (duarte.santamarina@usc.es)

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UNIVERSITY WHERE THE COORDINATOR IS: USC

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HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

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LECTURER 1: Manuel A. Sobreira Seoane (msobre@gts.uvigo.es)

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UNIVERSITY WHERE THE LECTURER 1 IS: UVigo

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HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

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LECTURER 2: Vicente Cutanda Henríque (vch@sense.sdu.dk)

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UNIVERSITY WHERE THE LECTURER 2 IS: UVigo

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HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

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### SUBJECT CONTENTS

1- Equations, Analytical Solutions and Numerical Methods for the Acoustic Equations in one dimension.

1.1 Review of the Wave Equations in one Dimension.

1.2 Multilayer Acoustic Transmission.

1.3 Numerical Methods. Dispersion and Pollution Error.

1.4 Simulation in Matlab and use of the Programme PAMM.

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## 2- Acoustic Equations in Two and Three Dimension.

2.1 Resolution Methods for the Fluid in rigid cavity. Numerical Calculus of the Resonance Frequencies.

2.2 Resolution Methods for the transient acoustics equation.

2.3 Use of the Programm COMSOL.

## 3- Application of the Acoustic Boundary Element Method.

3.1 Basic Theory. Helmholtz Integral Equation.

3.2 BEM in Problems 2D and 3D.

3.3 Formulation for Symmetric Axis Problems.

3.4 The Numerical Implementation of the BEM.

3.5 Description of the Package OPENBEM of MATLAB.

3.6 Problems 2D: Diffraction on Noise Barriers.

3.7 Symmetric Axis Problems: Diffraction on a Sphere and Radiation of a Pulsating Sphere.

3.8 Problems of 3D: Radiation of a Piston on a Sphere. Radiation of Cabinet Loudspeakers.

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## METHODOLOGY

Although the Subject Approach is basically practical, it will be presented at the beginning of each Theme a Short Theoretical Summary in Blackboard, to put in Context the Models and Numerical Method, before the Explanation of the Commercial Packages, which will make through the Video Cannon.

According to the Practical Character of the Subject, the Students will devote of Individual Way the most part of the Time, under the Supervision of the Teacher, to familiarize with the Computer Packages presented so to solve with them the Exercises and Problems that will refer along the Course.

With the methodology outlined above, the part of the competencies CG1, CG4, CE4, CE5, CS1, and CS2 that are contemplated in this subject is worked on.

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**LANGUAGE USED IN CLASS:** Spanish, Galician, Will depend on the audience.

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

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## BIBLIOGRAPHY

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

- G.C. Cohen. Higher-order numerical methods for transient wave equations. Springer-Verlag. Berlin, 2002

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- COMSOL Acoustics module. User's Guide and Model Library.
- F. Ihlenburg. Finite Element Analysis of Acoustic Scattering. Springer-Verlag. Berlin, 1998.
- The Boundary Element Method for Sound Field Calculations. PhD Peter Moller Juhl. Disponible en <http://www.openbem.dk/>

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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.

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

### Specific:

CE4: To be able to select a set of numerical techniques, languages and tools, appropriate to solve a mathematical model.

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

### Numerical specialization:

CS1: To know, be able to select or use how to handle most suitable professional software tools (both commercial and free) for the simulation of processes in the industrial and business sector.

CS2: To adapt, modify and implement software tools for numerical simulation.

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**WILL YOU BE USING A VIRTUAL PLATFORM?** No.

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**WILL YOU BE USING ANY SPECIFIC SOFTWARE?** Yes. Comsol [acousticsmodule ], Matlab and own software.

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## CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

The student will be evaluated from the exercises and problems throughout the course and a practical final exam.

The tests / activities described above fully evaluate the part of the competences CG1, CG4, CE4, CE5, CS1, and CS2 worked on this subject.

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## CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

The student will be evaluated from the exercises and problems throughout the course and a practical final exam.

The tests / activities described above fully evaluate the part of the competences CG1, CG4, CE4, CE5, CS1, and CS2 worked on this subject.

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