Inverse Problems and Image Reconstruction

ECTS: 6 ECTS

COORDINATOR: María Luisa Rapún Banzo (marialuisa.rapun@upm.es)

UNIVERSITY WHERE THE COORDINATOR IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? NO

LECTURER 1: Ana Carpio Rodríguez (ana_carpio@mat.ucm.es)

UNIVERSITY WHERE THE LECTURER 1 IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? NO

SUBJECT CONTENTS

Linear problems:
-Introduction
-Least squares
-Regularization
-L_1 Minimization
-Subspace methods
-Applications to Biomedicine

Non linear problems:
-Introduction
-Image reconstruction and regularization methods
-Applications

METHODOLOGY

Theory and solving techniques for inverse problems will be explained through simple examples. Then students will have to tackle more complex problems issuing from real-world applications (including those to industry) by applying and modifying solving techniques. They should be able to validate their results in the context of the application.

LANGUAGE USED IN CLASS: Will depend on the audience.

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

BIBLIOGRAPHY

Frank Natterer, Frank Wübbeling "Mathematical Methods in Image Reconstruction". Ed. SIAM (2001).

M. Bertero, P. Boccacci, "Introduction to Inverse Problems in Imaging" Ed. CRC Press (1998).

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.

CG3: To be able to integrate knowledge in order to state opinions using information that even incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge.

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:

CE3: To determine if a model of a process is well made and well mathematically formulated from a physical standpoint.

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? NO.

WILL YOU BE USING ANY SPECIFIC SOFTWARE? Yes. MATLAB

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

We will follow a continuous evaluation system of the student work that includes homework, participation in class and an oral exposition of a practical problem of interest.

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Written exam about the topics covered in the course.
