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Perturbation Methods

ECTS: 6 ECTS

COORDINATOR: Eduardo Jesús Sánchez Villaseñor (ejsanche@math.uc3m.es)

UNIVERSITY WHERE THE COORDINATOR IS: UC3M

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

LECTURER 1: Manuel Carretero Cerrajero (manuel.carretero@uc3m.es)

UNIVERSITY WHERE THE LECTURER 1 IS: UC3M

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

SUBJECT CONTENTS

- Basic notions of asymptotic analysis
- Approximation of integrals
- Solvability conditions for linear homogeneous problems
- Eigenvalue problems.
- Poincare-Linstedt method
- Scaling of singular perturbation problems
- Boundary layer methods and matched asymptotic expansions
- Asymptotic expansions coupled method.
- Method of multiple scales
- Chapman-Enskog method

METHODOLOGY

We present perturbation methods applied to physical and engineering systems and based on studying relevant examples. Solving the proposed problems and comparing these solutions to numerical or exact solutions is an essential part of the course.

LANGUAGE USED IN CLASS: Will depend on the audience

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

BIBLIOGRAPHY

- C. M. Bender & S. A. Orszag, Advanced Mathematical Methods for

Scientists and Engineers. Addison-Wesley, N. Y. 1978. Springer 1999.

- L.L. Bonilla & M. Carretero, Perturbaciones singulares. Notas de

clase. Universidad Carlos III de Madrid, 2009.

- L. L. Bonilla & S. W. Teitsworth, Nonlinear wave methods for charge

transport. Wiley-VCH, Weinheim, 2010.

- E.J. Hinch, Perturbation methods. Cambridge UP, 1991.

- J. Kevorkian & J. Cole, Multiple Scale and Singular Perturbation Methods. Springer, N.Y., 1996.

- P. A. Lagerstrom, Matched asymptotic expansions. Springer, N. Y. 1988.

- A. H. Nayfeh, Introduction to Perturbation Techniques. Wiley, N.Y. 1981.

SKILLS

Basic:

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:

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.

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

Modelling specialization:

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

CM2: To know how to model elements and complex systems leading to well-posed formulated problems.

WILL YOU BE USING A VIRTUAL PLATFORM? No.

WILL YOU BE USING ANY SPECIFIC SOFTWARE? No.

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

Continuous evaluation of the student's work based either on essays, participation in class and a presentation before an audience or a written exam (skills CG5, CE3, CM1, and CM2 will be evaluated).

Percentages: 100% (continuous evaluation) or 100% (written exam).

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Written exam (skills CG5, CE3, CM1, and CM2 will be evaluated)
