Stability of Physical Systems

ECTS: 6 ECTS

COORDINATOR: Jose Manuel Vega de Prada (josemanuel.vega@upm.es)

UNIVERSITY WHERE THE COORDINATOR IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 1: Jeff Porter (jeff.porter@upm.es)

UNIVERSITY WHERE THE LECTURER 1 IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 2: Jose J. Sánchez Álvarez (jjsanchez@fmetsia.upm.es)

UNIVERSITY WHERE THE LECTURER 2 IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

LECTURER 3: Maria Higuera (maria.higuera@upm.es)

UNIVERSITY WHERE THE LECTURER 3 IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? Yes

SUBJECT CONTENTS

.Some preliminaries; linear algebra and ordinary differencial equations.

-Linear stability for autonomous and periodic systems.

-Pitchfork and transcritical bifurcations.

-Hopf bifurcation and nonlinear oscillations.

-Codimension-one bifurcation for periodic systems.

-Mode interaction.

-Chaotic dynamics.

METHODOLOGY: Blackboard and transparencies, combining theory and applications.

LANGUAGE USED IN CLASS: Spanish, English

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

BIBLIOGRAPHY

- V. Arnold, Ordinary Differential Equations, MIT Press, 1973.

- V. Arnold, Geometrical Methods in the Theory of Ordinary Differential Equations, Springer-Verlag, 1983.

- P. Glendinning, Stability, Instability and Chaos, Cambridge University Press, 1994.

- J. Guckenheimer y P. Holmes, Nonlinear Oscillations, Dynamical Systems and Bifurcation of Vector Fields, Springer-Verlag, 1983.

- Y.A. Kuznetsov, Elements of Applied Bifurcation Theory, Springer, 1998.

- S.H. Strogatz, Nonlinear Dynamics and Chaos, Westview Press, 2001.

- S. Wiggins, Introduction to Applied Nonlinear Dynamical Systems and Chaos, Springer-Verlag, 1990

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? Yes. Moddle (UPM).

WILL YOU BE USING ANY SPECIFIC SOFTWARE? No.

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

Essays to be completed both individually and in groups.

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Final exam for those students that fail the continuous evaluation.