DEGREE CURRICULUM

FLUIDS ENGINEERING

Academic year 2014-15

FLUIDS ENGINEERING 2014-15

Subject's general information

Subject name	Fluids Engineering
Code	102302
Semester	2n Q Avaluació Continuada
Typology	Obligatòria
ECTS credits	6
Theoretical credits	0
Practical credits	0
Office and hour of attention	Desk 2.08 EPS
Department	Informàtica i Enginyeria Industrial
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Catalan
Degree	Degree in Engineering Mechanics
Office and hour of attention	Desk 2.08 EPS
E-mail addresses	jilla@macs.udl.cat

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Josep Illa

Subject's extra information

Suggestions

The present course is based on the concepts already exposed in Mechanics of Fluids and is intended to achieve the level of analysis commonly used in the practice of engineering design. The difficulty in the analysis of complex fluid systems forces the use of numerical computational techniques where the major handicap is the accurate design of the algorithms adapted to each problem type. Those algorithms will be implemented in Matlab. It is recommended for the student to refresh the concepts of Fluid Mechanics, Numerical Methods and Programming given in previous courses.

The course as part of the academic plan

The fluids system engineering is a part of mechanics, considered as a whole discipline. With that background the present course will give a practical perspective integrating concepts both from Mechanics and from Fluid Mechanics. The course will take place during the second semester and is structured in 3cr theory, 2cr problems and 1cr practicum. In the individualized practicum specific problems will be proposed and the student will have to develop a strategy to solve and implement them in Matlab. Some basic references for the course are in english.

Learning objectives

Veure apartat de competències.

Competences

Degree-specific competences

- Applied knowledge to thermal engineering

  Goals

  - Ability to apply the concepts of mass and energy balance to the analysis of fluids systems.
- Applied knowledge of the principles of hydraulic engineering systems and machines.

  Goals

  - Achieve a global understanding of the working principles of the fluid mechanics machines and of its integration in a fluid network.

Degree-transversal competences

- Ability to resolve problems and elaborate and defend arguments inside their field of study

  Goals

  - Reach the ability to establish hypothesis to simplify the resolution of a problem and to analyze the sensitivity of the obtained results on the established assumptions.
- Ability to analyse and synthesize.

  Goals

  - Reach the ability to analyze fluid systems and to establish strategies to solve a given problem.

Subject contents

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Chapter 1. INTRODUCTION TO MATLAB

1. Types of variables in Matlab
2. Logical and arithmetic operators
3. Mathematical functions
4. Loops and conditionals
5. Main programs and user defined functions
6. Basic numerical algorithms:
    - -Bisection and secant methods
    - -The Newton-Raphson method for non linear equation systems
    - -Ordinary differential equations: The Euler method
    - -Fitting curves with the least squares criterion

Chapter 2. BASIC PIPE CONFIGURATIONS

1. Series pipe configuration
2. Parallel pipe configuration
3. Characteristics of pumps in series and parallel
4. Working point
5. Similitude laws in centrifugal pumps
6. The three reservoir problem
7. Optimal diameter
8. Use of the elemental numerical algorisms in Matlab

Chapter 3. INTRODUCTION TO PIPE NETWORK ANALYSIS

1. General concepts. Basic types of networks
2. Power law and the Darcy-Weisbah equation
3. Branched networks. Trickling irrigation
4. Method of the continuity equations (Q- eqs method)
5. Method of the energy equations (H-eqs method)
6. Method of Hardy-Cross (?Q eqs method)
7. Introduction of singular elements in the network
8. Introduction of a pump in the network
9. Problems of pipe network analysis

Chapter 4. TRANSIENT FLOW

1. Analysis of systems with pseudo transient flow

2. Incompressible transient flow in rigid pipes

3. Basic description of the water hammer. Practical calculations

4. Equations governing the water hammer

5. Numerical solutions. The characteristics method

6. Transients in networks

7. Problems of transients

Chapter 5. NON NEWTONIAN FLOWS

1. Classification and industrial use

2. Interaction between fluids and particles

3. Fluid transport with suspended particles

4. Rheological properties of fluids

5. Non newtonian pipe fluid flow

6. Problems using non newtonian fluids

Evaluation

There will be a test by mid semester (E1) and by the end of the semester (E2) and a final recuperation exam (EF) on the dates fixed by the Direction of the EPS. During the course there will be at least 5 problems proposed (P) due to be solved and discussed at a established date. Solving those problems is optional, but it contents is subject of the exams. The final mark for a person who has not presented all the problems (NJa) will be calculated as:

$$NJa=\max\{(E1+E2)/2, E2\}$$

while for a person who has presented all problems (NJb) and has NJa >3 will be calculated as:

$$NJb= 0.5*NJa + 0.45*P + 0.05*A$$

where A is a mark reflecting the professor global appraisal. Those who did not pass at the first attempt will have a second opportunity where the final recuperation exam (EF) will replace the mark NJa.

Bibliography

Basic references:

-J.Agüera Soriano, “Mecánica de fluidos incompresibles y turbomáquinas hidráulicas”, 5ª ed., Editorial Ciencia3 S.A., 2002 (ISBN: 84-95391-01-05)

- Claudio Mataix, “Mecánica de fluidos y máquinas hidraulicas” , 2ª ed.,Ediciones del Castillo S.A., Madrid 1986 (ISBN: 84-219-0175-3).

-V.L. Streeter, E.Benjamin, K.W. Bedford, “Mecánica de los fluidos”, Ed. McGraw-Hill, 9ª ed., 2000 (ISBN: 968-600-987-4).

-Irving H. Shames, “Mecánica de fluidos”, Ed. McGraw-Hill, 1995

Advanced references:

-Bruce E. Larock, Roland W. Jeppson, “Hydraulics of pipelines systems”. Ed. CRC Press. 2000 (ISBN: 0-8493-1806-8).

-R.P.King, “Introduction to practical fluid flow” Ed. Butterworth-Heinemann 2002 (ISBN: 0-7506-4885-6).

-Frank M.White, “Fluid Mechanics”, Ed. McGraw-Hill, 1986