UE Secteur

UE SECTEUR

Modules Ouverts Sectoriels

AÉRODYNAMIQUE TRANSSONIQUE

TRANSONIC AERODYNAMICS

Lecturers: Stéphane AUBERT

| Lecturers : 20.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : AN

Objectives

Understanding the physical behaviour of compressible gas at high Mach number is crucial to design transonic and supersonic airplanes as well as modern gas turbines. This course objective is to cover the basic theories of supersonic aerodynamics, then to apply these to external flows (around airfoil and fuselage nose) and to internal flows (in compressors and turbines).

Keywords : compressible flows, supersonic, show wave, expansion wave, interactions, analytical methods

Programme

1. Toolbox : Reminders of fluid mechanics and thermodynamics
2. One-dimensional flow : Normal shock relations
3. Oblique shock and expansion waves : Prandtl-Meyer function ; waves reflections
4. External flows : Critical Mach number ; sound barrier ; bow shock
5. Quasi-one dimensional flow : nozzles
6. Transonic axial compressor flows

Learning outcomes

- To elaborate and to apply formulations adapted to compressible and transonic flows
- To understand transonic aerodynamics phenomena in external and internal flows
- To judge the accuracy of models to estimate quantities of interest from a design point of view

Independent study

Objectifs :

Méhodes :

Core texts

N.A. Cumpsty, *COMPRESSOR AERODYNAMICS*, Krieger Publishing Company, 2004
J.D. Anderson *MODERN COMPRESSIBLE FLOW*, Mc Graw Hill, 2021

Assessment

Final mark = 100% Knowledge
Knowledge = 100% final exam

ALGORITHMES POUR LA DÉCISION EN ENTREPRISE

GAME THEORY AND ALGORITHMS

Lecturers: Joël PERRET LIAUDET, Philippe MICHEL

| Lecturers : 14.0 | TC : 4.0 | PW : 0.0 | Autonomy : 0.0 | Study : 10.0 | Project : 0.0 | Language : FR

Objectives

In this course, we show how to model some complex problems encountered in various domains (biology, politics, economics, design, ...) by dealing with non-standard optimization algorithms (heuristics, meta-heuristics) and game theory.
On simple cases, we will illustrate these resolution processes.

Keywords : optimization algorithm, heuristics, game theory.

Programme

Complexity / Heuristics / Simulated annealing / Genetic algorithms / Ant system / Particule swarm optimization
Game Theory

Learning outcomes

- - solve applied optimization problems - modeling and application viaheuristic method - modeling and application via game theory

Independent study

Objectifs :

Méhodes :

Core texts

J. Dréo, A. Pétrowski, P. Arry, E. Aillard , *MÉTAHEURISTIQUES POUR L'OPTIMISATION DIFFICILE.* , Eyrolles, 2003
Colin et Camerer. *BEHAVIORAL GAME THEORY: EXPERIMENTS IN STRATEGIC INTERACTION.* , The Roundtable Series in Behavioral Economics, 2003

Assessment

> Final mark = 50% Knowledge + 50% Know-how
> Knowledge = final exam
> Know-how = continuous assessment

BRUIT DES TRANSPORTS AÉRIENS ET TERRESTRES

AIR AND GROUND TRANSPORTATION NOISE

Lecturers: Marc JACOB, Mohammed ICHCHOU

| Lecturers : 16.0 | TC : 0.0 | PW : 8 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : AN

Objectives

Noise is perceived as the highest annoyance by EU citizens and noise induced stress, to which transportation noise is a major contributor, is the 2nd largest cause of pollution related diseases in Europe after air pollution, according to WHO. Therefore, sound levels both inside transportation systems and in the surrounding environment, must be considered already at design: regulatory constraints are increasingly severe; acoustic and vibratory comfort is often a key for customer choices. Transportation noise has multiple origins: propulsion and engine systems, ventilation and air conditioning, unsteady flow around vehicles... This course deals with sound sources due to the different transport modes and their consequences on the perceived noise levels inside

Keywords : Acoustics, noise, vibration, comfort, nuisances, transportation systems, car, train, aeronautics

Programme

•Transportation noise: General features, regulations and certification.
•Noise sources in air transportation. Legislation and certification. (SAFRAN AE)
•Noise reduction methods for air transportation noise. (SAFRAN AE)
•An overview of ground transportation noise: sources and mitigation
•Localisation and identification of sources. Advanced measurement techniques (SAFRAN AE).
•Analysis of structure-borne noise. Vibroacoustics. Statistical energy analysis (SEA). Basics of numerical vibroacoustics.

Learning outcomes

- Grasp the noise and vibration issues in transport
- Identify and be able to analyze noise sources in transport
- Solve typical problems in transportation noise

Independent study

Objectifs : •Apply several approaches used to address transportation noise issues to practical situations.
•Carry out a critical result analysis

Méhodes : •1 Case study
•2 Lab classes
•1 Visit

Core texts

M. P. Norton, *FUNDAMENTALS OF NOISE AND VIBRATION ANALYSIS FOR ENGINEERS*, Cambridge University Press, 1989
F. Fahy *ENGINEERING ACOUSTICS.*, Academic Press, 2001
T.D. Rossing*SPRINGER HANDBOOK OF ACOUSTICS.*, Springer Verlag, 2007

Assessment

Score = N1 (50%) knowledge + N2 (50%) know-how
•N1: Written exam
•N2 : Case study and lab class reports

CALCULS AVANCÉS EN DYNAMIQUE DES VÉHICULES

CALCULS AVANCÉS EN DYNAMIQUE DES VÉHICULES

Lecturers: Mohammed ICHCHOU, Olivier BAREILLE

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

CHOIX DES MATÉRIAUX ET DES ASSEMBLAGES

CHOICE OF MATERIALS AND ASSEMBLAGE

Lecturers: **Michelle SALVIA, Stephane BENAYOUN**

| Lecturers : 14.0 | TC : 4.0 | PW : 8.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

M.F. Ashby, Y. Bréchet, L. Salvio, *SÉLECTION DES MATÉRIAUX ET DES PROCÉDÉS DE MISE EN OEUVRE*, Presse Polytechniques et Universitaires Romandes, 2001
J.M. Berthelot *MATÉRIAUX COMPOSITES : COMPORTEMENT MÉCANIQUE ET ANALYSE DES STRUCTURES*, Lavoisier, 2005

Assessment

COMPATIBILITÉ ÉLECTROMAGNÉTIQUE DES SYSTÈMES DE PUISSANCE ET INTERACTION

ELECTROMAGNETIC COMPATIBILITY OF POWER SYSTEMS, INTERACTION WITH

Lecturers: Christian VOLLAIRE

| Lecturers : 12.0 | TC : 4.0 | PW : 4.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : FR

Objectives

The massive use of telecommunications and electrical energy conversion systems leads to having to take into consideration the "electromagnetic pollution" linked to human activity, the objective being safety (electromagnetic cohabitation). With the development of increasingly autonomous devices (renewable energies, cars, drones), electromagnetic access routes (waves, cables, etc.) have become potential inputs for signals aimed at disrupting operation or even taking control of the target. We can also mention the problems of exposure of people to electromagnetic fields from human activities that must be controlled. Objectives: presentation of sources of disturbances, couplings, failures and countermeasures.

Keywords : Electromagnetic compatibility, natural sources of disturbances and those linked to human activity (intentional or not), couplings, victims, exposure to electromagnetic waves, countermeasures, modeling, measurement techniques, standards

Programme

1 The issue of EMC
2 Electromagnetic fields and propagation
3 Sources of disturbance (natural origin, human origin, intentional or not)
4 Study of conducted and radiated coupling modes
5 Current studies and testing
6 Methods of prevention and protection
7 Electromagnetic fields and biological systems

Learning outcomes

- At the end of this course, students will be able to analyze EMC phenomena in complex systems, to propose analysis methods and solutions. They will be able to discuss with experts in the field through knowledge of the EMC vocabulary, the phenomena at work, the normative constraints and the usual solutions.

Independent study

Objectifs :

Méhodes :

Core texts

P. Degauque, J. Hamelin , *COMPATIBILITÉ ELECTROMAGNÉTIQUE* , Dunod, 1990
R. Perez *HANDBOOK OF ELECTROMAGNETIC COMPATIBILITY* , Lavoisier
Yvon Mori*COMPATIBILITÉ ELECTROMAGNÉTIQUE*, Hermes Lavoisier, Paris, 2007

Assessment

Score = 70% knowledge + 30% practical work
Knowledge score = 100% final exam + 0% continuous evaluation
practical work score = = 100% final exam + 0% continuous evaluation

CONFORT ET ÉNERGIE DE L'HABITAT

CONFORT ET ÉNERGIE DE L'HABITAT

Lecturers: Eric VINCENS

| Lecturers : 20 | TC : 0 | PW : 0 | Autonomy : 0.0 | Study : 8 | Project : 0.0 | Language : FR

Objectives

While Housing represents nearly 40% of total energy consumption in France and contributes 25% to greenhouse gas emissions, controlling the energy performance of buildings is becoming a major issue in building a future. sustainable. This course proposes to provide tools for designing a high-performance envelope and for producing energy for a more frugal habitat, but also tools for diagnosing the existing one.

Keywords : frugality, comfort, air renewal, energy for the building

Programme

- 2020 Environmental standard (RE2020) and labels
- Home comfort
- Frugal solutions for building energy production
- Photovoltaics for buildings

Learning outcomes

- - build a static and dynamic model to quantify heat losses - build the process to assess heating needs - choose technical solutions for heating the production of domestic hot water

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

- knowledge score: final exam without documents
- know-how score: notes from the BE

CONTRÔLE ACTIF DU BRUIT ET DES VIBRATIONS

ACTIVE NOISE CONTROL AND VIBRATION

Lecturers: Marie Annick GALLAND, Mohammed ICHCHOU

| Lecturers : 10.0 | TC : 0.0 | PW : 8.0 | Autonomy : 0.0 | Study : 10.0 | Project : 0.0 | Language : MI

Objectives

Active control systems have been widely developed in the last 20 years. The basic principle is well known : a secondary wave, 180° out of phase, is synthetized to interfere with the primary one. Active noise or vibration control therefore aims to reduce an existing noise or vibration, especially at low frequencies, where passive means are unefficient. The
objective of this course is to introduce the basic principles and the main realizations in mechanics. Other topics are also investigated: active absorption, semi-active control, smart materials...

Keywords : active control, acoustics, vibration, fluid mechanics, adaptive filters, real time, analog filters

Programme

1- active noise control
2- adaptive algorithms
3- energy in active systems. Local control/ global control
4- semi-active and active control of vibrations
5- LQG control - MIMSC control
6- smart structures
7- vibro-acoustic control
8- active control of flow instabilities

Learning outcomes

- to identify potential applications of active control systems
- to select the suited active control technologies
- to design an active control system
- to discuss about active systems' limitations

Independent study

Objectifs : The practical activities (12h) reflect the variety of applications :
- active headset
- real time systems for noise control
- active vibration control of a structure

Méhodes : 2 Experimental Work sessions (Lab Work)
1 Practical Work

Core texts

Stephen Elliott , *SIGNAL PROCESSING FOR ACTIVE CONTROL*, Academic Press, 2001
Leonard Meirovich *DYNAMIC AND CONTROL OF STRUCTURES*, John Wiley and Sons, 1990
P.A. Nelson, S.J. Elliott*ACTIVE CONTROL OF SOUND*, Academic Press, 1992

Assessment

Final mark = 45% Knowledge + 40% Know-How +15% Methodology
K= 10% final exam + 35% Continuous Assessment
KH=40% Continuous Assessment

COUCHES ULTRAMINCES ET SURFACES FONCTIONNALISÉES

FUNCTIONALIZED THIN LAYERS AND SURFACES

Lecturers: Virginie MONNIER-VILLAUME, Stephane BENAYOUN

| Lecturers : 14 | TC : 4.0 | PW : 4 | Autonomy : 6 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The objective is, in a first part, to study the relationship between elaboration conditions of thin films, structure and associated micro/nanostructure, and the desired specific properties in various application fields: mechanics, optics, electronics, chemistry and biology. The search of new performances, the development of nanotechnologies and the need for innovation require a mutifunctional approach for the conception of the objects. On the surface, i.e. at the interface with the external medium, sollicitations, damages, or specific properties are occuring and must be optimized and/or considered to be different from the ones of the bulk material.

Keywords : Thin film, deposition methods, defects, electrical properties, supraconductivity, optical properties, mechanical properties, self-assembled monolayers, sol-gel

Programme

During this course, we will particularly study the mechanical properties (elasticity, plasticity, damage and adhesion of the films on the substrate), the electrical properties (influence of bidimensionality on the carriers, films of nanometric thickness taking into account the quantum nature of their electronic properties), the optical properties (application to integrated optics and obtention of specific functional properties) of thin films. The last part of the course will be dedicated to the study of self-assembled monolayers and their applications. A practical session will allow the students to take part to a molecular beam epitaxy experiment in the cleanroom.

Learning outcomes

- Know the mechanism and elaboration systems of a thin film.
- Know the different properties and applications of a thin film.

Independent study

Objectifs :

Méhodes :

Core texts

Bethany R. Hughes, Yaser Dahman *FABRICATION AND SELF-ASSEMBLY OF NANOBIOMATERIALS APPLICATIONS OF NANOBIOMATERIALS, CHAPTER 14*

Assessment

Final mark = 100% Knowledge
Knowledge = 100% final exam

DYNAMIQUE DES MÉCANISMES

DYNAMIC MECHANISMS

Lecturers: **Joël PERRET LIAUDET, Alain LE BOT**

| Lecturers : 12.0 | TC : 6.0 | PW : 0.0 | Autonomy : 0.0 | Study : 10.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Georges Spinnler, *CONCEPTION DES MACHINES, PRINCIPES ET APPLICATIONS VOL. 2 DYNAMIQUE* , Presses polytechniques et universitaires romandes, 1998

Assessment

ECONOMÉTRIE DES SÉRIES TEMPORELLES

TIME SERIES ANALYSIS

Lecturers: **Christian DE PERETTI**

| Lecturers : 28 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

A time series - or time series - is a sequence of observations indexed by time. The temporal and joint dynamics of time series are modelled by discrete-time stochastic processes. The main applications of time series are the modelling of macroeconomic and financial series. They can also be used in other sciences such as physics, biology, geology (Nile floods, Hurst 1951), health (hormone levels in blood), etc.

The objective of this time series course is to review a large number of econometric models without going into mathematical demonstrations: for univariate stationary (ARMA models, application to short-term interest rates),

Keywords : Discrete-time stochastic processes, econometrics, estimation, testing, economic interpretation, neural networks, Eviews software.

Programme

Chap 1: Introduction to the concept of time series.
Chap 2. Autoregressive moving average models (ARMA)
Basic model.
+ recurrent neural networks. LSTM.
Chap 3. Autoregressive conditional heteroskedasticity models (ARCH)
Models specific to the returns of financial securities.
They take into account periods of volatility observed in financial markets.
+ Neural volatility models
Chap 4. Notion of unit root and ARIMA models

Learning outcomes

- Knowledge: time series modelling by stochastic process. Know-how: Applications to macroeconomic and financial problems.

Independent study

Objectifs : Non.

Méhodes :

Core texts

Walter Enders, *APPLIED ECONOMETRIC TIME SERIES*, Wiley, 2014

Assessment

50% one-hour examination.
50% project in pairs.

ECOULEMENTS INSTATIONNAIRES EN TURBOMACHINE

UNSTEADY FLOW IN TURBOMACHINE

Lecturers: Stéphane AUBERT, Alexis GIAUQUE

| Lecturers : 24.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : AN

Objectives

Exchanges between the fluid and the structure are involved in turbomachinery either to extract energy from the fluid (turbines), or to transfer energy to the fluid (compressors). While these energy levels may be very large, one part may be diverted to feed unsteady mechanisms, leading some time to the machine blowout. The course objective is to study some of these unsteady mechanisms and to answer basic questions : why and how are they generated, how do they grow, is it possible to control them or to delay their onset, is it possible to simulate them numerically or to measure them experimentally ?

Keywords : turbomachinery, unsteady flows, aeroelasticity, instabilities, coupled phenomena

Programme

1. Out-of-design performances degradation : operability reduction due to cumulative effects in multi-rows machines; quasi-steady or fully unsteady phenomena
2. Rotor-stator interactions : potential effects in subsonic and supersonic regimes; wakes behaviour through turbines and compressors channels; forced vibration of the structure
3. Aerodynamic instabilities : description, analysis and model of surge; rotating stall; example of recent research in multi-stages axial compressors
4. Fluid-structure coupling and aeroelasticity instabilities : history of failures related to flutter; specificities of flutter in turbomachinary

Learning outcomes

- To name the main unsteady phenomena in turbomachinery
- To formulate interaction scenarios between these phenomena
- To evaluate the characteristic frequencies of these phenomena
- To split in basic physical phenomena the complex behaviour of a turbomachine from data based on simulations or measurements

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Final mark = 100% Knowledge
Knowledge = 100% final exam

ENERGIE ET IMPACT SUR L'ENVIRONNEMENT

ENERGY AND ENVIRONMENTAL IMPACT

Lecturers: **Jean-Pierre CLOAREC**

| Lecturers : 12.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 16 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

ENTREPRENEUR

ENTREPRENEURIAL COACHING

Lecturers: **Sylvie MIRA**

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Develop entrepreneurial competencies and create a startup

Keywords : business creation - entrepreneurial finance - entrepreneurial law

Programme

Legal aspects of business creation
Financial dimensions of business creation
Startup management

Learning outcomes

- Implement a business creation process
- Know how to finance a business creation
- Know the different legal status of a startup

Independent study

Objectifs : Implementation of a startup creation process

Méhodes : Practical work with potential customes, competitors, financial plan

Core texts

Alexander Osterwalder, Yves Pigneur, Alan Smith. , *BUSINESS MODEL GENERATION*, WILEY, 2010
Eric Ries. *THE LEAN STARTUP.*, CURRENCY,, 2017

Assessment

Continuous monitoring of project progress

GÉOTECHNIQUE

ADVANCED SOIL ENGINEERING

Lecturers: **Eric VINCENS**

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

This course presents the design of the foundations of structures as well as the techniques for retaining soils in the works or final phase. It is based on knowledge of soil mechanics which should have been
acquired through MOD2.6 or ELC-C6.

Keywords : shallow foundations, deep foundations, retaining wall, reinforcement

Programme

Shallow foundations
Deep foundations
Retaining walls and soil reinforcement

Learning outcomes

- - how to analyze the data constraints of a geotechnical project - sizing a geotechnical system (foundation, reinforcement) - how to choose a technological solution

Independent study

Objectifs :

Méhodes :

Core texts

Georges Filliat, *LA PRATIQUE DES SOLS ET FONDATIONS*, EDITIONS DU MONITEUR, 1981
Philippe Mestat *DE LA RHÉOLOGIE DES SOLS À LA MODÉLISATION DES OUVRAGES GÉOTECHNIQUES*, LCPC, 2000

Assessment

- knowledge score: a final test with part without documents and part with documents
- know-how score: reports from BE

GESTION DES RESSOURCES NATURELLES

MANAGEMENT OF NATURAL RESOURCES

Lecturers: Pietro SALIZZONI, Mathieu CREYSSELS, Richard PERKINS

| Lecturers : 14.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 14.0 | Project : 0.0 | Language : MI

Objectives

The aim of this course is to provide students with the background knowledge required to understand the distribution, availability and exploitation on the earth's natural resources. The course also addresses the impact of the use of natural resources on the environment and on society.

Keywords : Natural resources, environment, energy, economic growth

Programme

1. Man and the environment – historical overview
2. Future scenario– growth or collapse ?
3. Mineral resources
4. Energy sources
5. Legal aspects
6. Natural resources and conflicts

Learning outcomes

- Students should be familiar with the broad classes of natural resources and their distribution on earth.
- Students should be aware of the different demands made on the earth's natural resources, and the underlying reasons for those demands
- Students should be aware of the impact of resource exploitation on the environment and society
- Students should acquire a basic understanding of the links between exploitation of resources and the growth or collapse of society.

Independent study

Objectifs :

Méhodes :

Core texts

J. Diamond, *GUNS GERMS AND STEEL*, WW Norton, 1997
V. Smil *ENERGY AND CIVILIZATION: A HISTORY*, The MIT Press, 2018
D. MacKay*SUSTAINABLE ENERGY – WITHOUT THE HOT AIR*, UIT Cambridge, 2008

Assessment

Mark = 50% knowledge + 50% know-how
Knowledge mark = 100% terminal exam
Know-how mark = 100% final exam

HYDROLOGY AND HYDROGEOLOGY

HYDROLOGY AND HYDROGEOLOGY

Lecturers: Richard PERKINS, Ariane EMMANUELLI, Pietro SALIZZONI

| Lecturers : 14 | TC : 0.0 | PW : 6 | Autonomy : 0.0 | Study : 8 | Project : 0.0 | Language : FR

Objectives

Water is a natural resource essential to life, and although it covers 71% of the earth's surface, only a small fraction of this water is directly usable. Worse, this fraction is distributed very unevenly over the earth's surface, and the ever-increasing demand for water renders its management ever more critical. The engineer has a central role to play in the control and management of water resources.

Hydrology is the science of the water cycle - the exchanges between the atmosphere, the earth's surface and the subsoil. More specifically, hydrogeology is the science of groundwater.

Keywords : Hydrology, hydrogeology, water resources, precipitation, hydrographs, evaporation, evapo-transpiration, Darcy, porous media.

Programme

1. Introduction
   - the hydrological cycle
   - the distribution of water over the planet
   - a short history of water management and water treatment

2. The hydrological cycle
   - water in the atmosphere: moisture and precipitation
   - evapo-transpiration

Learning outcomes

- Students should be familiar with the major components of the hydrological cycle, and the interaction between them. They should be able to estimate their importance through order-of-magnitude calculations.
- Students should understand how to develop models which combine physical principles with real data, and should be able to apply these to the laboratory classes.
- Students should have mastered the basic equations for flow in porous media, and should be able to solve them for simple situations. They should be able to develop solutions for more complex situations through the superposition of solutions for simpler

Independent study

Objectifs :

Méhodes :

Core texts

Brutsaert, W., *HYDROLOGY: AN INTRODUCTION*, Cambridge University Press, 2005
Freeze, R.A. & Cherry, J.A. *GROUNDWATER*, Pearson, 1979
Shaw, E.M.*HYDROLOGY IN PRACTICE*, Taylor & Francis, 2010

Assessment

Knowledge 50% Know-how 50%
Knowledge: 40% Exam + 60% Continuous assessment
Know-how: 40% Exam + 60% Continuous assessment

INFORMATIQUE D'ENTREPRISE

ENTERPRISE COMPUTING

Lecturers: Daniel MULLER, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Through a series of conferences led by professionals, this course aims to provide a better knowledge of systems, applications, methods, and professions of IT in companies, whose realities are often very different and much richer than the vision that may have students.

Keywords : Business IT, information systems, IT trades.

Programme

Here are some conferences that have taken place in previous years:

"e-payment services", Cédric Lamarzelle, Atos Worldline
"Service-oriented architecture", Matthieu Girardin, CGI
"Information technology and freedoms", Correspondent for information technology and freedoms, Centrale Lyon
"HPC and Big Data virtualization", Jean-Daniel Bonnetot, OVH,
"Open-Source jobs", Valentin Clavreul, Smile
"Application Outsourcing", Philippe Ihuel, Sopra Group

Learning outcomes

- Understand the complexity and diversity of IT in business.
- Have an idea of the various IT professions in business.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

MCQ covering all the conferences, based on questions submitted by each of the speakers.

INFORMATIQUE GRAPHIQUE

COMPUTER GRAPHICS

Lecturers: Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

This course will present notions of computer graphics, and mainly those related to the realistic rendering of 3D images. It notably introduces notions of raytracing/pathtracing and lighting simulation (the rendering equation), textures and representation of materials, representations of 3D geometry, camera models, Monte Carlo simulation and integration, and importance sampling, acceleration structures, surface parametrization and perception. During this course, you will entirely develop in C ++ a realistic image rendering engine (graded) based on a Monte Carlo simulation that you will improve over the course of the lectures.

Keywords : Computer Graphics, 3d rendering, raytracing, Monte Carlo integration, lighting simulation

Programme

You will start the course with an almost empty code. Over the course of the explanations, you will first add the possibility to render simple diffuse spheres with point lights and direct lighting. You will add gamma correction, anti-aliasing, and the handling of reflective and transparent spheres. After a lecture on Monte Carlo Simulation and the Rendering Equation, you will add indirect lighting, extended light sources to achieve soft shadows, as well as depth of field blur. Finally, you will add support for more complex 3D shapes through textured meshes.

Learning outcomes

- 3d rendering: At the end of this course, you will be able to implement a simple but realistic 3d rendering engine, and will understand related concepts.
- Monte Carlo integration: At the end of this course, you will understand how to stochatically integrate functions, and know variance reduction techniques.
- Programming: This course will strengthen your programming skills, through the implementation of non-trivial data structures (e.g., Bounding Volumes Hierarchies) and a motivating application.

Independent study

Objectifs :

Méhodes :

Core texts

Matt Pharr, Wenzel Jakob, Greg Humphreys , *PHYSICALLY BASED RENDERING: FROM THEORY TO IMPLEMENTATION. HTTPS://PBRT.ORG/*, Elsevier, 2016
Peter Shirley *RAY TRACING IN ONE WEEKEND. HTTPS://RAYTRACING.GITHUB.IO/* , 2016

Assessment

Note = 33% savoir + 67% savoir-faire
Note de savoir = 100% examen terminal
Note de savoir-faire = 100% contrôle continu.

INTRAPRENEUR

BUSINESS DEVELOPMENT

Lecturers: **Marie GOYON**

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Faced with the challenges of the call for innovation in the companies and in the public sector, this training aims to allow engineering students to train in the issues and practices of innovation, the design of innovative projects and their strategic support (intrapreneurship). Theoretical training (innovation management, project management, open innovation, innnovate with labs, agile methods, ecosystems and labs, companies social responsibilities) and project-driven training with one or more partner companies. A case study can also be realized.
OPEN to all Students

Keywords : innovation, strategy, management, design, agility, intrapreneurship, project

Programme

Courses, workshops, coaching, autonomy
Themes: Design thinking and agile methods, prototyping, communication, negotiation, open innovation, innovation strategies,actors, field surveys, buisness models, patent monitoring

Learning outcomes

- conduct an innovation process: design, manage, realize
- lead an innovation strategy: actors and stakeholders, strategy development and planning, negotiation and communication
- federate and manage a project team
- adopt a transversal and agile project practice

Independent study

Objectifs : Realization of a project (design, communication and strategy)

Méhodes : Project, coaching, fieldwork

Core texts

Assessment

Oral presentations and report

INGÉNIERIE TISSULAIRE ET BIOMATÉRIAUX

TISSUE ENGINEERING AND BIOMATERIALS

Lecturers: Emmanuelle LAURENCEAU, Vincent FRIDRICI

| Lecturers : 24.0 | TC : 0.0 | PW : 0.0 | Autonomy : 4.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The objective of this course is to address the problems of repair and replacement of biological tissues, as well as to give the bases and principles of tissue engineering through different examples (orthopedics, vascular, dental, skin)

Keywords : Material-living interactions, biomaterials, tissue reconstruction, prostheses

Programme

Cells and extracellular matrix
Biocompatibility and biomaterials
Biomaterials in dentistry
Bone tissue engineering and mechanical behavior
Vascular prostheses, orthopedic ...
Skin tissue engineering and tribology

Learning outcomes

- - Know the basics of cellular functioning - Explain the principles of tissue engineering - Select a biomaterial for a given application - Evaluate a scientific publication

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Final mark = 100% final written exam

MACRO ENERGIE

MACRO ENERGY

Lecturers: Jean-Pierre CLOAREC

| Lecturers : 28.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The development model of today's societies is based on energy consumption that is not sustainable in the long term. This course therefore aims to enable engineers to acquire a global vision of the energy system, which is indispensable both to the understanding of the current context and the challenges that future generations will have to face. The course provides fundamental knowledge on geopolitical, economic and technical aspects of various energy sectors and their deployment or shutdown at the international and local level.

Keywords : Geopolitics of energy; primary, secondary and final energy, energy balance, energy chains; energy-climate; energy-development; international, national, local scales

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

MICROSYSTÈMES, MICROCAPTEURS, MICROFLUIDIQUE

MICROSYSTEMS, MICROSENSORS, MICROFLUIDIC

Lecturers: Emmanuelle LAURENCEAU, Ian O CONNOR

| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : FR

Objectives

Starting from the example of a lab-on-chip for biological analysis, the issues related to the integration of different components and functions on a miniaturized system will be developed and clarified. An introduction to microfluidics (physics at the microfluidic scale, influence of the laws of scale on the miniaturization of systems, hydrodynamics of microfluidic systems, diffusion, mixing and separation in microsystems) as well as the notions necessary for understanding the problems of Acquisition of the very low amplitude signal will be presented. The cases of chemical and biological sensors will be particularly developed.

Keywords : Miniaturized system, sensor and biosensor, integration, microfluidics

Programme

Chemical, biological and physical microsensors
Electrokinetics, diffusion and mixing in microsystems
Electronic detection, noise level, electronic control of sample movement
BE1: Bibliographic study of a biosensor
BE2: Microfluidics
BE3: Electronic signal processing

Learning outcomes

- - Know the basics of how a microsensor works - Know how to develop a microsystem for a given application - Extract data - Analyze a scientific publication

Independent study

Objectifs :

Méhodes :

Core texts

Cooper Jonathan M., *BIOSENSORS*, Oxford University Press, 2004
Folch Albert *INTRODUCTION TO BIOMEMS*, CRC Press, 2013
Tabeling Patrick*INTRODUCTION À LA MICROFLUIDIQUE*, Belin, 2003

Assessment

Final mark= 33% mark BE1 + 33% mark BE2 + 33% mark BE3

MODÉLISATION ET GESTION DU TRAFIC

TRAFFIC MANAGEMENT AND MODELLING

Lecturers: Olivier BAREILLE, Ludovic LECLERCQ

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Treiber, Keisting., *TRAFFIC FLOW DYNAMICS: DATA, MODELS AND SIMULATION*, Springer Verlag, New York, 2013
Daganzo *FUNDAMENTALS OF TRANSPORTATION AND TRAFFIC OPERATIONS*, Pergamon Press, 1997
Elefteriadou*AN INTRODUCTION TO TRAFFIC FLOW THEORY*, Springer, 2014

Assessment

NOUVELLES TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION

NEW TECHNOLOGIES OF INFORMATION AND COMMUNICATION

Lecturers: Daniel MULLER, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

At the convergence of IT, telecommunications, corporate networks, and multimedia, the world of Information and Communication Technologies is constantly changing and therefore requires active monitoring by stakeholders. involved. This training action aims to introduce students to technological watch, both theoretically and practically. In coordination with the teaching team, the students will put technological watch into practice by carrying out their own study on a freely chosen subject. Each student will be asked to present his results to all his peers during workshops organized for this purpose.

Keywords : Technological watch, information and communication technologies, innovation.

Programme

Introduction to technological and strategic watch
The challenges - The tools
The main areas of technology watch - choice of an issue
Individual presentations by the students of the selected subjects

Learning outcomes

- To be able to carry out a technological watch.
- Knowing how to identify innovations in your sector of activity.
- Be able to report to peers.

Independent study

Objectifs :

Méhodes :

Core texts

F. Jakobiak, *L'INTELLIGENCE ÉCONOMIQUE, TECHNIQUES ET OUTILS.* , Dunod,, 2009

Assessment

Final Mark Score = 20% knowledge + 70% know-how + 10% interpersonal skills
Knowledge score = 100% methodological report
Interpersonal skills score = attendance

OUVRAGES DE PRODUCTION D'ENERGIE

CONSTRUCTION OF ENERGY PRODUCTION

Lecturers: **Eric VINCENS, Pierre BRUN**

| Lecturers : 20.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : FR

Objectives

- Know the installations associated with the production of nuclear, hydroelectric and wind energy.
- Know how to apply the basic concepts of design and safety

Keywords : Power systems, nuclear power plant, dams, safety, design, wind power

Programme

Nuclear works
1. Presentation of general site plans (relative locations and role of structures)
2. The texts governing the design and operation of nuc structures, having an impact on the design
3. Safety requirements and general civil engineering installation
4. Design of structures: from basic texts to sizing criteria
5. Introduction to simplified reliability studies applied to civil engineering
6. Containment enclosures

Learning outcomes

- - Layout design - Safety Assessment

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

- knowledge score: final exam without documents
- know-how score: BE study by group of 2 & visit report

PHÉNOMÈNES COMPLEXES EN DYNAMIQUE DES STRUCTURES

COMPLEX PHENOMENA IN STRUCTURAL DYNAMICS

Lecturers: Olivier DESSOMBZ, Jean-Jacques SINOU

| Lecturers : 4.0 | TC : 24.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The behavior of real structures often exceeds the basic mechanics framework for various reasons. The non-deterministic nature of the structures, the presence of nonlinearities are taken into account to better understand the behavior of these structures in real cases operating in engineering.
We propose here to give tools and address the conventional methods of engineering for introducing randomness and non-linearities in the systems, and to describe and more realistically the behavior of real structures and their optimization. Particular attention will also be paid to the engineer's process of defining a relevant mathematical model with regard to the experimental observations. These tools will be

Keywords : Solid Mechanics, Structural Dynamics Engineering of complex systems, Uncertainty, Optimization, Stability, Nonlinear Systems

Programme

1) Introduction
2) Instability
3) Nonlinear behavior and methodology
4) Dispersions
5) Structural optimization

Learning outcomes

- Formulate a complex problem in structural dynamics
- Explain physical phenomena in structural dynamics
- Evaluate according to the dynamic operating criteria of an object
- Knowing the sources of uncertainties and nonlinearities and how to model them

Independent study

Objectifs :

Méhodes :

Core texts

A.H. Nayfeh and D.T. Mook, *NONLINEAR OSCILLATIONS*, John Wiley & Sons, 1979
A. Preumont *VIBRATIONS ALÉATOIRES ET ANALYSE SPECTRALE*, Presses Polytechniques Romandes, 1990
D.-J. Ewins*MODAL TESTING: THEORY, PRACTICE AND APPLICATION*, Study Press,, 1984

Assessment

Final mark = 30% Knowledge + 70% Know-how
Knowledge = 100% final exam
Know-how = 100% continuous assessment

POLLUTION ATMOSPHÉRIQUE

ATMOSPHERIC POLLUTION

Lecturers: **Lionel SOULHAC, Didier DRAGNA, Pietro SALIZZONI**

| Lecturers : 16.0 | TC : 4.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PROBLÈMES EN DOMAINES NON BORNÉS : ANALYSE MATHÉMATIQUE ET SIMULATION

PHYSICAL PROBLEMS IN UNBOUNDED MEDIA : MATHEMATICAL ANALYSIS AND NUMERICS

Lecturers: Laurent SEPPECHER, Grégory VIAL

| Lecturers : 10.0 | TC : 6.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : MI

Objectives

This course aims at giving the mathematical foundations for the study of partial differential equations posed in an unbounded domain. We will focus on model equations (Laplace, Helmholtz, wave equation) to present the mathematical framework and the main ideas for the design of numerical methods.

Keywords : Propagation phenomena. Partial differential equations. Unbounded domains.

Programme

Part I : Basic facts for stationary and harmonic problems

Part II : Time dependent problems

Part III : Focus on the Helmholtz problem in the free space

Learning outcomes

- To be able to identify conditions for closing a problem in an unbounded domain.
- To be able to design a numerical method for PDEs in unbounded domains.
- To be able to quantify the accuracy of such a numerical method.

Independent study

Objectifs : Basics on finite elements softwares.
Practice on methods developed during lectures.

Méhodes : Application exercises.

Core texts

J.-C. Nédelec, *ACOUSTIC AND ELECTROMAGNETIC EQUATIONS*, Springer, 2001
D. Givoli *NUMERICAL METHODS FOR PROBLEMS IN INFINITE DOMAINS*, Elsevier, 1992
L. Lehmann*WAVE PROPAGATION IN INFINITE DOMAINS*, Springer, 2007

Assessment

Grade = 50% knowledge + 50% knowhow
Knowledge grade = 100% final exam
Knowhow grade = 100% continuous assessment

PROCÉDÉS GÉNÉRAUX DE CONSTRUCTION

TECHNIQUES FOR CONSTRUCTION

Lecturers: **Eric VINCENS**

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Construction techniques in the construction industry
Discovery of work in public works and construction companies

Keywords : Public Works, Civil Engineering, Methods, Construction, Site works

Programme

Recent activity report for conventional and alternative sectors
Safety on construction sites
The methods for building
Facades in construction
LCA in the construction industry
Building differently: participatory housing
Price studies

Learning outcomes

- - Understand the context and the work environment - Know how to choose construction methods - Technical culture

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

- knowledge score: final test without documents in the form of multiple choice questions
- know-how score: reports of site visits
MOS7.3 final score= 1/2 * knowledge + 1/2 * know-how

VÉHICULES HYBRIDES : MODÉLISATION ET GESTION DE L'ÉNERGIE

HYBRID ELECTRIC VEHICLES : MODELLING AND ENERGY MANAGEMENT

Lecturers: Arnaud BREARD

| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : FR

Objectives

The aim of this course is to present electric and hybrid vehicles. Modeling, sizing and energy management of hybrid vehicles and their components are studied. Twelve hours will be spent for practical works to develop and simulate vehicle models. These sessions mainly deal with the developement of a model of electric vehicle, the modelling and the energy management of Toyota Prius, and the energy management of serial hybrid vehicles.

Keywords : Hybrid vehicle, electric vehicle, cybernetic model, battery, engine, electrical machine, pollutant, energy management, emission standards, environnemental impact

Programme

The teachers in charge of this session are researchers of IFSTTAR working on Electric and Hybrid Vehicles.
1) Hybrid electric vehicle : generalities, definitions, classification and cybernetic modelling.
2) The batteries for electric and hybrid vehicles : introduction, modelling, uses, sizing, security and ageing.
3) Engines and electrical machines : presentation, different types of electrical machines and their controls, different types of engines, anti-pollution norms, application for electric and conventional vehicles.

Learning outcomes

- Understand the operation principles of the main components of hybrid vehicles (engine, battery, electronic converter,...)
- Modelling of a hybrid vehicle
- Sizing the components of a hybrid vehicle
- Simulate the energy management in a hybrid vehicle

Independent study

Objectifs :

Méhodes :

Core texts

Lino Guzzella, Antonio Sciarretta, *VEHICLE PROPULSION SYSTEMS - INTRODUCTION TO MODELING AND OPTIMIZATION.*, Springer, 2013
Chris Mi, M. Abul Masrur, David Wenzhong Gao *HYBRID ELECTRIC VEHICLES: PRINCIPLES AND APPLICATIONS WITH PRACTICAL PERSPECTIVES.*, Wiley, 2011

Assessment

Final mark = 60% Knowledge + 40% Know-how
Knowledge N1 = 100% final exam
Know-how N2 = 100% continuous assessment

VISUALISATION INTERACTIVE DE DONNÉES

INTERACTIVE DATA VISUALIZATION

Lecturers: **Romain VUILLEMOT**

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

This course aims at presenting the tools and methods located at the ends of the Big Data processing chain: visually exploring data before modeling them, visually communicating analysis results. This step is crucial for data analysts, but also for decision makers who need to understand complex results without being experts, through intuitive graphical interfaces and dashboards.

Keywords : Data visualization, multidimensional projection methods, graph layout algorithms, benchmark and visualization software development, testing methodology, JavaScript, Observable Notebooks.

Programme

- Introduction to data visualization;
- Principles of visual encoding, perception, cognitive principles and design;
- Typology of graphics, interaction and animation techniques;
- Case studies, paper prototyping;
- Algorithmic aspects and software architectures of visualization;
- Case studies and use of industry standard tools (Tableau, Raw, Google Fusion Table);
- Introduction and advanced JavaScript;
- Web visualization project.

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Tamara Munzner, *VISUALIZATION ANALYSIS AND DESIGN*, CRC Press, 2014

Assessment

Written exam and web project (+ defense)

STABILITÉ DES MACHINES TOURNANTES

EXPERIMENTAL METHODS IN MECHANICS

Lecturers: Laurent BLANC, Fabrice THOUVEREZ

| Lecturers : 16.0 | TC : 0.0 | PW : 8.0 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : AN

Objectives

Rotating machines as systems for propulsion (turbojet engines...), energy production (windmills, alternators...) or ay system needing to rotate a shaft (pump, gyroscope, centrifuges...) hold an important place in everyday life. These machines obey the laws of dynamics and often evolve in a multiphysical context: fluid-structure interaction, mechatronics. This lesson's purpose is to provide the key elements for such systems modelling, concentrating on stability aspects. Indeed this point is essential because a lot of energy is concentrated in these machines and their stability is major concern for their good functionning as well as for safety.

Keywords : Rotating machine. Stability. Vibration

Programme

I/ Reminder of rotating elastic structure equations, modal characterictics in fixed and rotating frame.
II/ Linear systems stability analysis: equations with constants coefficients, equations with periodic coefficients. Introduction to non-linear systems stability
III/ Rotors stability problems: phenomenological analysis, analysis of structural elements leading to instabilities:
• Symmetry, dissipation, buckling in rotating parts • Bearings characteristics
• Rotor / stator coupling • Fluid-structure coupling • Non - linear phenomena causing instability (bifurcation...)

Learning outcomes

- To understand rotordynamics specific points
- To know how to put into equations rotordynamics problems
- To know how to assess for a rotating machine dynamics and stability
- To know the different organs of a turbomachine

Independent study

Objectifs : To get informed of rotating machines state of the art

Méhodes : Research papers analysis, by binoms + presentation to the group

Core texts

R. Bigret, *STABILITÉ DES MACHINES TOURNANTES ET DES SYSTÈMES*, Publication CETIM, 1997
F. F. Ehrich *HANDBOOK OF ROTORDYNAMICS*, Krieger Publishing Company, 2004
M. I. Friswell, J. E. T. Penny, S. D. Garvey and A. W. Lees*DYNAMICS OF ROTATING MACHINES*, Cambridge Aerospace series, 2010

Assessment

Lab mark
Paper comment mark
Written exam mark

STRATÉGIE D'ENTREPRISE

STRATEGIC MANAGEMENT

Lecturers: Sylvie MIRA

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Understand how to design a corporate strategy
Implement a business analysis aligned with a resources based view and the competitive dynamics
Understand how to finance the company's growth

Keywords : Business strategy - competitive advantage - resources based view - growth

Programme

The fundamentals of strategy
Strategy and marketing
International strategy and operations management
Growth strategy and finance

Learning outcomes

- Understand value creation mecanism
- Know how to evaluate a company's set of resources and processes
- Know how to evaluate competitors' strategy
- Understand financial growth leverages

Independent study

Objectifs : Implement kowledge on case studies

Méhodes : Group work on case studies

Core texts

Frery F., *STRATÉGIQUE*, Pearson, 2014
Meier O. *STRATÉGIES ET CHANGEMENT - INNOVATIONS ET TRANSFORMATIONS DES ORGANISATIONS*, Dunod, 2013
Garette B., Lehman L.*STRATÉGOR - TOUTE LA STRATÉGIE DE LA START-UP À LA MULTINATIONALE*, Dunod, 2020

Assessment

Case study

SÛRETÉ DE FONCTIONNEMENT DES SYSTÈMES ET DES STRUCTURES

HEALTH MONITORING

Lecturers: Michelle SALVIA, Olivier BAREILLE

| Lecturers : 0.0 | TC : 28.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : AN

Objectives

In the transportation and the energy-supply industry, a rigorous and reliable maintenance strategy shall be applied.
In this course, the methods of control and health-monitoring will be described. Their advantages and limitations will be addressed and discussed.
Some specific materials and technique dedicated to the structural health monitoring will be reviewed. The topic will be

Keywords : structures surveillance
ageing, material damages for structures
signal processing
wear and damage index

Programme

The SHM steps
Measurement and sensor systems
Composite material in aeronautics : application of the SHM
Smart materials
Damage models and predictive models

Learning outcomes

- establishing a monitoring strategy
- identification of damage phenoma
- data analysis and compared studies

Independent study

Objectifs :

Méhodes : The 8 lectures are completed by 3 sequences of lab (1 experimental + 2 numerical).

Core texts

J. Lemaître, *A COURSE ON DAMAGE MECHANICS*, Springer Verlag, New York, 1996
Adams Douglas E. *HEALTH MONITORING OF STRUCTURAL MATERIALS AND COMPONENTS*, Wiley, 2007
Karbhari Vistasp M. and Ansari Farhad*STRUCTURAL HEALTH MONITORING OF CIVIL INFRASTRUCTURE SYSTEMS*, Woodhead Publishing CRC Press, 2009

Assessment

Final exam (knowledge - coeff. 0,3)
Document analysis and practical exercises (know-how - coeff. 0,6)
Practice (methodology - coeff. 0,1)

UE SECTEUR

Option Mathématiques et Décision

UE SECTEUR

Modules Spécifiques Option Mathématiques et Décision

UE SECTEUR

Libelle english

MATHÉMATIQUES ET INGÉNIERIE DU RISQUE

MATHEMATICS AND RISK ANALYSIS

Lecturers: Marie-Christophette BLANCHET

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The third year specialization « Applied mathematics and risk engineering » is devoted to mathematical modeling and numerical simulation of problems arising in engineering.Students study a wide range of stochastic and deterministic methods concerning ordinary and partial differential equa-tions, optimization problems, discrete and time-continuous stochastic processes, statistics., together with the associated numerical methods.Opportunity is given to the best students to complete their formation with a master degree in one of the three following fields : applied mathematics, fInance / insurance, biomathematics / biostatistics.

Keywords :

Programme

Learning outcomes

- Up to date mathematical technics
- Tools for scientific monitoring
- Necessary background for an applied mathematics PhD

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

ADVANCED TOOLS FOR LEARNING : WHEN CONVEXITY MEETS SPARSITY

PRACTICAL MATHEMATICS

Lecturers: Céline HARTWEG-HELBERT, Yohann DE CASTRO

| Lecturers : 15.0 | TC : 15.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : AN

Objectives

Sparsity and convexity are ubiquitous notions in Machine Learning and Statistics. In this course, we study the mathematical foundations of some powerful methods based on convex relaxation: L1-regularisation techniques in Statistics and Signal Processing; Nuclear Norm minimization in Matrix Completion. These approaches turned to be Semi-Definite representable (SDP) and hence tractable in practice. The theoretical part of the course will focus on the guarantees of these algorithms under the sparsity assumption. The practical part of this course will present the standard solvers of these learning problems.

Keywords : L1-regularization; Matrix Completion; Semi-Definite Programming; Proximal methods;

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Christophe Giraud, *INTRODUCTION TO HIGH-DIMENSIONAL STATISTICS*, Chapman and Hall/CRC
Martin J. Wainwright *HIGH-DIMENSIONAL STATISTICS: A NON-ASYMPTOTIC VIEWPOINT*, Cambridge University Press
Simon Foucart and Holger Rauhut*A MATHEMATICAL INTRODUCTION TO COMPRESSIVE SENSING*

Assessment

INTRODUCTION AUX MATHÉMATIQUES FINANCIÈRES

INTRODUCTION TO MATHEMATICAL FINANCE

Lecturers: Marie-Christophette BLANCHET, Elisabeth MIRONESCU

| Lecturers : 14.0 | TC : 4.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : FR

Objectives

This course presents in detail the classical models used in mathematical finance in discret and continuous times. It includes three sessions of numerical implementation. It is based on the Stochastics Processes course (MOD) given during the first part of the year.

Keywords : Mathematical finance, Cox-Ross-Rubinstein model, Black-Scholes model, stochastic calculus, pricing and hedging options.

Programme

Cox-Ross- Rubinstein model
Black-Scholes model and some extensions

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Damien Lamberton et Bernard Lapeyre, *INTRODUCTION AU CALCUL STOCHASTIQUE APPLIQUÉ À LA FINANCE*, Ellipses, 1997
Peter Tannkov et Nizar Touzi *CALCUL STOCHASTIQUE ET FINANCE (EN ANGLAIS)*, http://www.cmap.polytechnique.fr/~touzi/Poly-MAP552.pdf, 2018
Damien Lamberton and Bernard Lapeyre*INTRODUCTION TO STOCHASTIC CALCULUS APPLIED TO FINANCE.* , Chapman and Hall 2nd Edition, 2008

Assessment

3 practical work sessions
1 written exam

PROBLÈMES INVERSES ET IMAGERIE

INTRODUCTION TO INVERSE PROBLEMS

Lecturers: **Abdel-Malek ZINE, Laurent SEPPECHER**

| Lecturers : 20.0 | TC : 2.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PROJET IM

PROJET IM

Lecturers: **Marie-Christophette BLANCHET**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8 | Project : 50 | Language : FR

Objectives

Through this project, students will identify mathematical problems/ barriers, propose solutions and implement them. They will also improve their communication skills to present the results (in written and oral forms).

Keywords : Modelization, Analysis, Simulations.

Programme

Learning outcomes

- Build a model
- Analyzis of a determnistic or random model
- Use of an appropriated software to perform simulation

Independent study

Objectifs : rite a report, build a presentation.

Méhodes : Group Work, pair work.

Core texts

Assessment

Report and defense

UE SECTEUR

Filière Aide à la Décision pour l'Entreprise

SIMULATION DE DÉCISIONS OPÉRATIONNELLES

PROCESS SIMULATION

Lecturers: Sylvie MIRA , Emmanuel BOUTLEUX

| Lecturers : 12.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 32.0 | Project : 0.0 | Language : FR

Objectives

The main objective is to model information flows within an organization (production system, logistics platform, administration, communication network, ...). Whether designing or analyzing an organization, the evaluation phase is an unavoidable step. Indeed, before making often heavy investments, it is imperative to ensure that the solutions envisaged meet the objectives. This course provides training on both the principles and tools of mathematical analysis and simulation tools for the specification, modeling and evaluation of information flows.
This course will focus on practical applications of Petri nets modeling and event simulation software such as

Keywords : Information flows analysis, operationnal simulation and optimisation

Programme

Methods and concepts explanation
Simulation on Petri networks within Witness software

Learning outcomes

- Be able to use behaviour based models
- Be able to analyse a flow model
- Be able to use model results for decision

Independent study

Objectifs : Competence acquisition on model and software

Méhodes : Group work on sotfware

Core texts

Assessment

Group work on projet

FINANCE ET MARCHÉS

BUSINESS GAME

Lecturers: **Sylvie MIRA**

| Lecturers : 12.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 24.0 | Project : 0.0 | Language : FR

Objectives

The course aims to bring deep insights of commercial and financial key performance indicators and competencies to design decision support tools for financial and commercial strategy

Keywords : key performance indicators, customer relationship management, corporate strategy

Programme

- Corporate finance
- Commercial strategy

Learning outcomes

- Be able to design key performance indicators (KPI)
- Be able to understand KPI to plan actions

Independent study

Objectifs : Group work on KPI for corporate decision making

Méhodes : Case studies

Core texts

Assessment

Case studies

PILOTAGE ET MANAGEMENT

DECISION SUPPORT SYSTEMS

Lecturers: **Sylvie MIRA**

| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The course aims to place the students in a situation of decision-making in a company by working on their cognitive process and to give them the keys to designing and implementing management systems.

Keywords : Cognitive process, risks, management

Programme

- Cognitiv process
- Risk / decision anaysis
- Management and dashboard

Learning outcomes

- Understand cognitive process activated in decision making
- Design a financial dashboard
- Assess financial impact of strategic decision

Independent study

Objectifs : Work group to understand analysed processes

Méhodes : Case studies

Core texts

SELMER, C., *CONCEVOIR LE TABLEAU DE BORD*, DUNOD, 2015

Assessment

Case studies

PROJET ADE

PROJECT

Lecturers: **Sylvie MIRA**

| Lecturers : 0.0 | TC : 50.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Customised program to each project

Learning outcomes

- Be able to analyse an company's issue
- Be able to collect relevant data from technical aspects, markets and context
- Be able to implement a prospectiv anaysis
- Be able to communicate clear and justified solutions

Independent study

Objectifs : Be able to bring within 3 monts a solution to a company's issue

Méhodes : Group work

Core texts

Assessment

UE SECTEUR

Option Bio-Ingénierie et Nanotechnologies

UE SECTEUR

Spécifiques Option Bio-Ingénierie et Nanotechnologies

CONFÉRENCES ET VISITES

CONFERENCES AND VISITS

Lecturers: **Emmanuelle LAURENCEAU, Virginie MONNIER-VILLAUME**

| Lecturers : 20 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The objective is to make students discover the numerous possibilities of jobs linked to the bio-engineering and nanotechnologies fields. The different thematics will be présented in the form of seminars and conferences by researchers and professionals in these fields. Visits of industrial sites (STMicroelectronic, Sanofi-Pasteur, Becton-Dickinson) and research centers (CEA-LETI, CEA-INES, Synchrotron ESRF) will be also organized.

Keywords : Bio-engineering, nanotechnologies, jobs, conferences, visits.

Programme

- Challenges of medical imaging techniques
- Damage to prostheses
- Big-data and genomics
- Large-scale data processing
- The AURA industrial fabric in bioengineering and nanotechnologies
- Clinical trials in silico

Learning outcomes

- Identify/analyze the needs and social-economics constraints linked to health and nanotechnologies.
- Take into account the international dimension of research in bio- and nanotechnologies.
- Adopt a global vision and apprehend the field into its complexity.
- Enlarge scientific and technical knowledge.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

100% for participation.

PROJET OPTION BIO-INGÉNIERIE ET NANOTECHNOLOGIES

PROJECT OPTION BIO-ENGINEERING AND NANOTECHNOLOGY

Lecturers: Emmanuelle LAURENCEAU, Virginie MONNIER-VILLAUME

| Lecturers : 0.0 | TC : 0.0 | PW : 50.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Through (transdiciplinary or not) projects proposed by industrial partners or by research labs, students will identify technological hurdles, propose solutions and set up experiments. They will also learn how to present their results (in a written and oral report).

Keywords : Projects, industrial, research.

Programme

Learning outcomes

- Elaborate and apprehend a scientific and technical project.
- Identify the technological hurdles and set up the technological solutions.
- Achieve a synthesis of informations and a presentation of the results.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

35% (written report), 35% (oral), participation (30%)

UE SECTEUR

Filière Bio-Ingénierie

IMAGERIES MÉDICALES

IMAGERIES MÉDICALES

Lecturers: **Christelle YEROMONAHOS, Emmanuelle LAURENCEAU**

| Lecturers : 6 | TC : 0.0 | PW : 9 | Autonomy : 6 | Study : 8 | Project : 0.0 | Language : FR

Objectives

Through this course, 3 main imaging and image processing techniques will be discussed: electronic cryo-tomography, X-ray imaging and ultrasound imaging. Concrete examples of image reconstruction and modeling as well as manipulations on devices (RX, US) will help to understand the complete chain of image formation and its interpretation.

Keywords :

Programme

Course (6h):
- Principle of electronic cryo-tomography
- Principle of X-ray imaging
- Principle of Ultra-sound imaging

Practical work (9h): 1 pratical to choose on one of the 3 imaging techniques

Learning outcomes

- Understand the scientific challenges of medical imaging in terms of information extraction
- Understand the difficulties associated with reconstructing images from physical measurements and know the methods to overcome them
- Know the signal processing techniques used in ultrasound imaging

Independent study

Objectifs :

Méhodes : - Processing of electronic cryo-tomography images from free software (eman2 and Jsubtomo)
- Bibliographic studies
- Processing of data acquired on a research ultrasound system

Core texts

Assessment

75% knowledge (practical report), 25% know-how (oral presentation)

INTERACTIONS MATÉRIAU-VIVANT

INTERACTIONS MATÉRIAU-VIVANT

Lecturers: Emmanuelle LAURENCEAU, Vincent FRIDRICI

| Lecturers : 3 | TC : 2 | PW : 6 | Autonomy : 6 | Study : 4 | Project : 0.0 | Language : FR

Objectives

Through this course, the fundamental aspects linked to the biological, physicochemical and mechanical phenomena involved during the contact between a surface and a biological medium will be treated. The link with the bioengineering of interfaces and its application will be approached in various forms: analysis of articles, realization of devices, design office

Keywords :

Programme

Course (3h):
- Physico-chemistry of interfaces
- Biomechanics of interfaces

BE (4h): Tribo-mechanics of living tissue

Practical work (6h): Realization of a glucose biosensor

TD (2h): Restitution of the analysis of scientific articles

Learning outcomes

- Understanding the biomechanical challenges of aging and prosthetic medicine
- Know some techniques for characterizing living tissue
- Establishment of an experimental protocol
- Write a complete technical report, correctly referenced

Independent study

Objectifs :

Méhodes : Analysis of scientific articles

Core texts

Assessment

50% knowledge (oral presentation of review articles), 50% know-how (practical report)

BIOPRODUCTION

BIOPRODUCTION

Lecturers: **Emmanuelle LAURENCEAU**

| Lecturers : 4 | TC : 0.0 | PW : 7 | Autonomy : 2 | Study : 4 | Project : 0.0 | Language : FR

Objectives

This course will allow engineering students to identify the stages of production of a recombinant protein as well as the different purification methods, their roles and interests in bioproduction processes. The production of recombinant proteins by genetic engineering methods is a common process in most areas of biotechnology. Using perfectly mastered methods, this process makes it possible to obtain specific proteins, in particular of therapeutic interest, with a very high yield.

Keywords :

Programme

Course (4h):
- Principle of genetic engineering
- Production and purification of recombinant protein

BE (4h): Biofermenter

Practical (7h): Microbrewery

Learning outcomes

- Know the techniques of bio-production and characterization of biomolecules
- Set up an experimental protocol
- Present results in a relevant, rigorous and critical manner for analysis
- Write a complete technical report, correctly referenced

Independent study

Objectifs :

Méhodes : Preparatory work for the practical

Core texts

Assessment

50% knowledge (course exam and BE), 50% know-how (practical report)

BIO-INFORMATIQUE, BIO-STATISTIQUE ET MODÉLISATION

BIO-INFORMATIQUE, BIO-STATISTIQUE ET MODÉLISATION

Lecturers: Christelle YEROMONAHOS, Emmanuelle LAURENCEAU

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 15 | Project : 0.0 | Language : FR

Objectives

Through this course, basic statistical tools as well as modeling concepts and techniques will be discussed to allow engineering students to analyze and model data in the life sciences. From concrete examples, analysis and modeling strategies will be studied, and the development of a complete model will be worked out.

Keywords :

Programme

BE 1 (4h): Modeling of living tissue
BE 2 (4h): Cell membrane modeling in molecular dynamics
BE 3 (4h): Epidemiology and vaccination
BE 4 (3h): Statistical tools for life sciences

Learning outcomes

- Understanding modeling
- To be able to simulate and analyze a model
- Recognize the application contexts of statistical methods and implement them on datasets
- Understand the principle of molecular dynamics simulations

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

1 written report for each BE, each counting for 25% of the final mark

UE SECTEUR

Filière Nanotechnologies

MÉMOIRES POUR L'INTERNET DES OBJETS

MÉMOIRES POUR L?INTERNET DES OBJETS

Lecturers: Bertrand VILQUIN, Ian O CONNOR, Virginie MONNIER-VILLAUME

| Lecturers : 0.0 | TC : 0.0 | PW : 16 | Autonomy : 0.0 | Study : 4 | Project : 0.0 | Language : FR

Objectives

During this course, the students will have to understand the different physical properties that can be found inside a unic ferroelectric material with high potential for innovating applications. They will also elaborate, characterize and use miniaturized and ultrafast digital memories pour the Internet of Things (IoT).
The higher electronic mobility will be one of tomorrow challenges, such as IoT. In the future, the interaction with objects will not be done only using electronic chips or specific commands transmitted by a touch screen, but also by objects themselves.

Keywords : Ferroelectric material, digital memories, internet of things, elaboration, characterization.

Programme

BE1 (2h): clean room technologies, X-Ray diffraction.
TP1 (4h): nanomaterials deposition in clean room and elaboration of integrated digital memories.
TP2 (2h): structural characterization of ferroelectric digital memories.
TP3 (2h): electrical characterization of ferroelectric digital memories.
TP4 (8h): conception of electrical systems from digital memories.
BE2 (2h): presentation of the results and scientific discussions.

Learning outcomes

- Understand the challenges and problematics of the Internet of Things.
- Know and use clean room techniques and structural/electrical characterization methods.
- Conceive the architecture of an electrical system.
- Present results in a relevant, rigourous and critical manner, in view of an analysis.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

30% for the written report, 30% for active involvement and participation, 40% for the oral presentation of the report.

SURFACES INTELLIGENTES

SURFACES INTELLIGENTES

Lecturers: Magali PHANER GOUTORBE, Stephane BENAYOUN, Stéphane VALETTE,

| Lecturers : 0.0 | TC : 0.0 | PW : 16 | Autonomy : 0.0 | Study : 4 | Project : 0.0 | Language : FR

Objectives

In this course, the students will have to elaborate bio-inspired surfaces with specific functionalities (superhydrophobic, super-adhesive,..) thanks to nano/microtexturation. These surfaces will be characterized and analyzed regarding the two specific properties, their wettability and their adhesive potential.

Keywords : Bio-inspired surfaces, surface texturation, wettability, adhesion.

Programme

TP1 (4h): elaboration of functional surfaces.
TP2 (4h): topographic characterization (nanometric scale)
TP3 (4h): characterization of the wettability of textured surfaces
TP4 (4h): mechanical characterization of the adhesion
BE (2h): presentation of the results and scientific discussions

Learning outcomes

- Understand the challenges and problematics of functional surfaces.
- Know and use surface elaboration techniques.
- Characterization of surfaces at different scales.
- Set up an experimental protocol.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

50% for the work during practical sessions, 50% for the oral presentation.

GUIDAGE PHOTONIQUE

GUIDAGE PHOTONIQUE

Lecturers: Emmanuel DROUARD, Pedro ROJO ROMEO, Virginie MONNIER-VILLAUME

| Lecturers : 0.0 | TC : 0.0 | PW : 18 | Autonomy : 0.0 | Study : 2 | Project : 0.0 | Language : FR

Objectives

During this course, the students will experiment different aspects of the conception and realization of nanophotonic components in guided optics, on silicon substrate.
After an introduction (about the context of integrated photonics on silicon, challenges), using specific simulation tools, students will conceive the different photonic building blocks necessary to the elaboration of complex systems for routing./guiding light on silicon. They will workin clean room on the different aspects of elaboration (optical and electronic lithography, plasma-assisted etching,...). The elaborated structures will be then characterized by optical and electronic microscopies.

Keywords : Nano-photonics, photonic components, guided optics, lithography, microscopy.

Programme

BE1 (2h): context, challenges of nanophotonics on silicon, description of tools and methods (simulation, elaboration in clean room)
TP1 (4h): simulation of structures and basic components
TP2 (10h): elaboration of guided optics components in clean room
TP3 (4h): structural characterization (electron microscopy) and optical microscopy (guided optics characterization set-up) of elaborated components

Learning outcomes

- Understand the challenges and problematics of photonics on silicon.
- Know and use several techniques and equipments used in nanotechnologies.
- First approach of working in clean room environment.
- Conceive and achieve a photonic integrated system.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

30% for theoretical questions, 30% for involvement and active participation, 40% of methodology and experimental report

NANO-OPTIQUES

NANO-OPTIQUES

Lecturers: Christelle MONAT, Virginie MONNIER-VILLAUME

| Lecturers : 0.0 | TC : 0.0 | PW : 16 | Autonomy : 2 | Study : 2 | Project : 0.0 | Language : FR

Objectives

This training will be devoted to the elaboration, of nano-optical devices using with particular diffraction/reflection properties due to their periodic structuration at the wavelength scale. Different kinds of periodic systems will be studied and elaborated using physical routes from thin films (clean room technology) and chemical routes (from colloidal dispersions). Their structural and optical properties will be simulated and characterized.

Keywords : Photonic crystals, thin films, nanostructured periodic systems, opals, simulation, spectroscopy.

Programme

BE (2h): periodic structures, photonic crystals and synthetic opals.
TP1 (4h): simulation of optical properties of photonic crystals.
TP2 (4h): elaboration of synthetic opales by chemical route.
TP3 (4h): fabrication of Bragg mirrors in the clean room.
TP4 (2h): optical characterization by reflectivity.
TP5 (2h): structural characterization by scanning electron microscopy.
Autonomy (2h).

Learning outcomes

- Understand the challenges and problematics of photonic crystals and the origin of periodic structures properties.
- Know and use clean room techniques, colloidal chemistry and structural/optical characterizations.
- Simulate optical properties of some photonic structures.

Independent study

Objectifs : Writing of the report.

Méhodes : Write a full technical report, with correct references.

Core texts

Assessment

30% for answer to theoretical questions, 30% for active involvement and participation, 40% for the report writing.

UE SECTEUR

Option Aéronautique

UE SECTEUR

Spécifiques Option Aéronautique

CONFÉRENCES

LESSON AND CONFERENCES

Lecturers: **Jérôme BOUDET, Olivier DESSOMBZ**

| Lecturers : 20 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The conference cycle aims to provide a broader view of the different sectors and professions of aeronautics.

Keywords : Aeronautics, energy, sector, professions, challenges.

Programme

Cycle of 10 conferences of 2 hours, delivered by engineers working in different sectors / professions of aeronautics, energy, etc.

Learning outcomes

- To have a broader vision of the aeronautical field.
- Identify the challenges in the field of aeronautics.
- To know the opportunities offered by the aeronautical option.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Attendance

PROJET AVION

AERONAUTICS PROJECT

Lecturers: Damien CONSTANT, Jérôme BOUDET, Olivier DESSOMBZ, Olivier

| Lecturers : 2 | TC : 34 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : MI

Objectives

This project concerns the preliminary design of a business jet, with given specifications (number of passengers, range, runaway length...). The interactions of the global design choices are investigated with simplified models, using an iterative approach. This project is supported by Dassault Aviation.

Keywords : business jet, preliminary design

Programme

This project consists of two phases:
Phase 1: analyse and complete a pre-design tool, then use it to design an aircraft with given specifications.
Phase 2: deepening. For example: realization of a wing model and evaluation in wind tunnel, improvement of pre-design models, study of sensitivities...

Learning outcomes

- Identify the influence of the aircraft design parameters on the performance.
- Elaborate and implement a multi-disciplinary design process.
- Propose and assess models for preliminary design.

Independent study

Objectifs : Progress in the pre-design of the aircraft.

Méhodes : Each group of four students uses the documents provided, the software provided and the skills of the management team.

Core texts

D.P. Raymer., *AIRCRAFT DESIGN: A CONCEPTUAL APPROACH*, AIAA, 2012
L. Jenkinson, J. Marchman. *AIRCRAFT DESIGN PROJECTS.*, Elsevier, 2003
J.D. Anderson.*AIRCRAFT PERFORMANCE AND DESIGN*, McGraw-Hill, 1999

Assessment

Evaluation of the intermediate and final deliverables, including spreadsheets and oral presentation.

PROJET SPÉCIFIQUE

SPECIFIC PROJECT

Lecturers: **Jérôme BOUDET, Olivier DESSOMBZ**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

UE SECTEUR

Filière Acoustique et Vibrations

ACOUSTIQUE ET VIBRATIONS

AERONAUTICS

Lecturers: Olivier DESSOMBZ, Sebastien BESSET, Vincent CLAIR

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The purpose of the project is to evaluate the vibratory and acoustic disturbances related to the aircraft, by distinguishing the nuisances produced by the aircraft around the airports, that is to say the external noise, and the nuisances suffered by the aircraft in terms of internal noise or mechanical strength.
One of the objectives of this project is to obtain a dimensioning integrating several constraints related to the environment and / or safety, without neglecting the performance and robustness of the aircraft.

Keywords :

Programme

The proposed studies, which will be defined according to the sensitivity of the students, will use a strong interdisciplinarity in order to highlight the origin of the nuisances, and to examine realistic dimensioning solutions. Below are some project topics that have been realized in recent years:
Impact studies near airports for take-off and landing.
Optimization of traffic and trajectories to reduce the ground track of noise.
Estimation of the noise and vibration levels induced by the flow in cruising flight for the internal noise.
Location of surface acoustic sources from the knowledge of noise in the cabin.

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Participation, written report and defense

UE SECTEUR

Filière Guidage et Pilotage

GUIDAGE ET PILOTAGE

AERONAUTICS

Lecturers: Anton KORNIIENKO, Laurent BAKO, Olivier DESSOMBZ, Paolo MASSIONI

| Lecturers : 10 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 10 | Project : 54 | Language : MI

Objectives

The development of unmanned flights (aerospace) has led to the development of powerful control methods adapted to the strong constraints of this field: multi-actuators multi-sensors with important performance requirements. These methods were very quickly deployed in the military aeronautics (reactivity) before massively broadcast in the civil aeronautics. With the reinforcement of competition, it is crucial to manage energy as efficiently as possible in order to limit costs while ensuring the comfort and safety of passengers, which makes control systems indispensable. The objective of this project is to train in the methods of design and validation (robustness) powerful control systems, essential in the aerospace industry.

Keywords : Automatic, Multi-actuator multi-sensor control (multivariable), Flight mechanics, Robustness

Programme

We can break down the work to be done in three phases:
A first step of bibliographic study in which it will be necessary to become familiar with some notions of dynamics of flight, to understand the model of lateral movement, to formalize the specifications for the design of the laws of control. A series of lectures will be dedicated to flight
mechanics.
A second stage of actual design correctors. Depending on the specifications, students are asked to choose from a set of multivariable methods (placement of poles, H-infinity, LQG, ...), a suitable method for the calculation of the corrector.

Learning outcomes

- Know how to formalize the specifications of a control system
- Know how to design a multivariable control algorithm answering a complete specification
- Know how to analyze the robustness of a control system
- Know how to apply the skills above on a civil transport plane

Independent study

Objectifs :

Méhodes :

Core texts

Daniel Alazard, Pierre Apkarian, Christelle Cumer, Gilles Ferreres, Michel Gauvrit, *ROBUSTESSE ET COMMANDE OPTIMALE*, Cépaduès éditions, 1999
A. E. Bryson *CONTROL OF AIRCRAFT AND SPACECRAFT*, Princeton University Press,, 1994
S. Skogestad and I. Postlethwaite*MULTIVARIABLE FEEDBACK CONTROL: ANALYSIS AND DESIGN*, Wiley- BlackWell, 2005

Assessment

Participation, written report and defense

UE SECTEUR

Filière Matériaux et Structures

MATÉRIAUX ET STRUCTURES

AERONAUTICS

Lecturers: **Olivier DESSOMBZ**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The project will focus on a particular system to carry out an in-depth study based on the functional specifications.
For example :
Aircraft fuselage assembly (Mechanics of Structures + Materials).
Damping of sandwich panels for aircraft floor (Mechanics of Structures + Materials).
Bonding assembly of aerospace composites: non-destructive testing and characterization (Materials).

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Participation, written report and defense

UE SECTEUR

Filière Propulsion

PROPULSION

AERONAUTICS

Lecturers: **Jérôme BOUDET, Laurent BLANC, Olivier DESSOMBZ**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : AN

Objectives

Design of a turbojet engine, with aerodynamic and mechanical specifications. Multi-disciplinary project organization.

Keywords : turbojet engine, compressor, turbine, aerodynamics, thermodynamics, structural mechanics, shaft dynamics

Programme

The thrust determined during the aircraft project being specified, thermodynamic cycle calculations are used to define the overall architecture of the jet engine. A one-dimensional analysis then leads to the definition of the number of sub-components. 'Zooms' on particular components are finally made as practical and in-depth examples of expertise. For example:
- Detailed design of compressor stages, from 3D mechanical and aerodynamic simulations. Definition of a compromise between aerodynamics and mechanics.
- Analysis of the overall dynamics (tree, disks, links...).

Learning outcomes

- Formulate an engineering problem.
- Use knowledge and know-how for the detailed design of a system.

Independent study

Objectifs : Progress on design.

Méhodes : Simulations with different levels of fidelity.

Core texts

N.A. Cumpsty, *COMPRESSOR AERODYNAMICS*, Krieger Pub, 2004
B. Lakshminarayana *FLUID DYNAMICS AND HEAT TRANSFER OF TURBOMACHINERY*, John Wiley and Sons, Inc., 1996
F. F. Ehrich*HANDBOOK OF ROTORDYNAMICS* , 2004

Assessment

Participation, report and oral presentation.

UE SECTEUR

Option Energie

UE SECTEUR

Modules Spécifiques
Option Energie

PRODUIRE, STOCKER, ORGANISER LES ÉNERGIES

THERMAL PRODUCTION

Lecturers: **Eric VAGNON, Jean-Pierre CLOAREC**

| Lecturers : 18.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PROJET EN

EN PROJECT

Lecturers: Eric VAGNON, Jean-Pierre CLOAREC

| Lecturers : 0.0 | TC : 0.0 | PW : 50.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords : Projet; énergie;

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

UE SECTEUR

Filière Energie Embarquée

NOUVEAUX CARBURANTS

MOBILE SYSTEMS ENERGY

Lecturers: **Jean-Pierre CLOAREC**

| Lecturers : 26.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Hydrogène: enjeux et contraintes
Carburants de substitution, biocarburants
Pile à combustible
Energie des systèmes nomades

Learning outcomes

- Comprendre les enjeux de la consommation énergétique dans les systèmes nomades

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PÉTROLE ET GAZ

OIL AND GAS

Lecturers: **Jean-Pierre CLOAREC**

| Lecturers : 33.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

UE SECTEUR

Filière Energie d'Infrastructure

RÉSEAUX ÉLECTRIQUES

ELECTRICAL POWER NETWORK

Lecturers: Eric VAGNON, Jean-Pierre CLOAREC

| Lecturers : 14.0 | TC : 0.0 | PW : 8.0 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

INGÉNIERIE NUCLÉAIRE

NUCLEAR ENGINEERING

Lecturers: **Eric VAGNON, Jean-Pierre CLOAREC**

| Lecturers : 27.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

UE SECTEUR

Option Transition Ecologique et Territoires

UE SECTEUR

Modules Spécifiques Option Transition Ecologique et Territoires

UE SECTEUR

Filière Bâtiments et Infrastructures

CONSTRUCTIONS

MECHANICS FOR THE DESIGN OF BUILDINGS

Lecturers: **Eric VINCENS, Francesco FROIIO**

| Lecturers : 14.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 16.0 | Project : 0.0 | Language : FR

Objectives

Through this course, three construction technologies most representative of current practices are approached, namely reinforced concrete, prestressed concrete and steel construction.
The aim of this course is to provide tools for making technological choices, and calculation techniques for dimensioning beams, floors, columns as well as load-bearing walls. The European regulatory framework which should guide the engineer in the design is also addressed. All the Practical Sessions associated with these courses are supervised by professional engineers.

Keywords : reinforced concrete, prestressed concrete, steel construction

Programme

Steel construction: 2 practical sessions (4h each)
Reinforced concrete: lectures (10h) + 2 practical sessions (4h each)
Prestressed concrete: lectures (4h)

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Jean Perchat , *TRAITÉ DE BÉTON ARMÉ - SELON L'EUROCODE 2*, Le Moniteur, 2010
Henry Thonier *CONCEPTION ET CALCUL DES STRUCTURES DE BÂTIMENT : L'EUROCODE 2 PRATIQUE*, Presses de l'École nationale des ponts et chaussée, 2006
Jean-Pierre Muzeau, APK*MANUEL DE CONSTRUCTION MÉTALLIQUE*, Eyrolles Afnor éd., 2012

Assessment

1 grade from the final exam*0.75 + 1 grade from practical sessions*0.25

OUVRAGES POUR LA MOBILITÉ

TRANSPORTATION WORKS AND STRUCTURES

Lecturers: Eric VINCENS

| Lecturers : 12 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8 | Project : 0.0 | Language : FR

Objectives

Transportation facilities are characterised by a long linear of works in an environment often more aggressive than for buildings or by non-standard geometries requiring technological solutions which are specific to them.

Among them, we can cite works of art, railway infrastructures as well as tunnels. Here, the main principles of design and monitoring of these structures will be given to fully understand the issues specific to their mechanical behavior and their durability. The speakers are all engineers, specialists in the field.

Keywords : bridge, railway, tunnel

Programme

Bridges: CM 4h + 1BE 4h
Tunnels: CM 4h + 1BE 4h
Railways: CM 4h

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Bernard-Gely, Jean-Armand Calgaro, *CONCEPTION DES PONTS*, Presses de l'École nationale des ponts et chaussées, 1994
Michel Leboeuf *GRANDE VITESSE FERROVIAIRE.*, Cherche midi, 2014
Jean Sulem , Marc Panet*LE CALCUL DES TUNNELS PAR LA MÉTHODE CONVERGENCE-CONFINEMENT*, Presses de l'École nationale des ponts et chaussées, 2021

Assessment

Continuous evaluation, in particular through the Practical Sessions

PROJET TET

GCE PROJECT

Lecturers: Eric VINCENS, Pietro SALIZZONI

| Lecturers : 0.0 | TC : 0.0 | PW : 70.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The project is common to the three components of the "Option". It is based on the final project of the students's diploma from the National School of Architecture of Lyon belonging to the master's program "Eco-constructive and Architecture transitions". Through this interdisciplinary work between student-architects and student-engineers, the goal is to get engineering students to invest in a reflection on economically viable solutions, adapted to a Post-Carbon Society taking into account the scarcity of resources, the necessary energy frugality in a regenerated city.

Keywords : home comfort, structures, foundation engineering, pollution, LCA, circular economy

Programme

- Work on different themes at the Habitat and City scale including the lithosphere, hydrosphere and atmosphere
- 3 project monitoring meetings by theme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Marie-Hélène Contal, Jana Revedin, *ARCHITECTURES DURABLES : UNE NOUVELLE ÉTHIQUE POUR L'ARCHITECTURE ET LA VILLE*, Le Moniteur Editions, 2009
Laurence Lestel, Catherine Carré *LES RIVIÈRES URBAINES ET LEUR POLLUTION*, Quae, 2017
Jean-Jacques Terrin*VILLES ET CHANGEMENT CLIMATIQUE : ÎLOTS DE CHALEUR URBAINS*, Parenthèses, 2015

Assessment

0.33 * oral defense + 0.33 * final written report + 0.33 * 2 interim reports

UE SECTEUR

Filière Ville et Aménagement Durable

CLIMATOLOGIE URBAINE

QUALITY AND WATER TREATMENT

Lecturers: **Pietro SALIZZONI**

| Lecturers : 15 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 10 | Project : 0.0 | Language : MI

Objectives

The density of buildings and the construction materials used deeply alter the exchange of heat, humidity and momentum in the urban canopy, compared to a rural environment. These modifications induce very specific thermal and microclimatic conditions, which can in turn have a profound influence on the comfort of life. This module presents the issues associated with building architecture and urban planning to minimise the climate impact of urban areas, minimise the energy consumption of buildings and maximise the comfort of urban spaces.

Keywords :

Programme

Thermal comfort of urban spaces CM 11h + BE 6h
Natural ventilation of buildings: CM 4h + BE 4h
(4h CMs are shared with the HD Stream - Air Renewal)

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

RÉGÉNÉRATION ET RÉSILIENCE URBAINE

GEOGRAPHIC INFORMATION SYSTEM / CLIMATE CHANGE

Lecturers:

| Lecturers : 17 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : MI

Objectives

Conditional on the approval of the CE

Provide an overview of the issues associated with the transformation, conversion and regeneration of urban spaces to take account of the challenges arising from climate change and the need for sustainable development.

Keywords :

Programme

Urban hydrology CM 8h + BE 4h

Soil depollution and reclamation CM4h + BE4h

The political, sociological and economic issues involved in urban regeneration CM 5h

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Written exam: 50%
Project reports: 50%

PROJET TET

SOIL POLLUTION

Lecturers: **Eric VINCENS, Pietro SALIZZONI**

| Lecturers : 16.0 | TC : 0.0 | PW : 4.0 | Autonomy : 0.0 | Study : 4.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

UE SECTEUR

Filière Habitat Durable

CONFORT DE L'HABITAT

BUILDING COMFORT

Lecturers: **Eric VINCENS**

| Lecturers : 16 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : FR

Objectives

This course will aim to provide the tools to understand the physics of the building envelope and quantify the performance of the Habitat with regard to comfort, both in winter and in summer, in a world constrained by requirements increasingly stringent in terms of regulation.

Keywords : Thermal comfort, air renewal, light

Programme

- Thermal of environments, systems and individuals: CM 12h + 3 BE
- Air renewal: 4h CM shared with VAD "filière"

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Malek Jedidi, Omrane Benjeddou, *DU CONFORT THERMIQUE AU CHOIX DES ÉQUIPEMENTS DE CHAUFFAGE ET DE CLIMATISATION*, Dunod, 2016
Jean-Pierre Moya *ISOLATION THERMIQUE DURABLE DES BÂTIMENTS EXISTANTS - CHOIX MULTICRITÈRES - MANUEL PRATIQUE*, Le Moniteur Editions, 2018
Bureau Veritas*ISOLATION THERMIQUE ET ACOUSTIQUE DES BÂTIMENTS : RÉGLEMENTATION, PRODUITS, MISE EN OEUVRE*, Le Moniteur Editions, 2017

Assessment

1 grade from the final exam *0.67 + 1 grade from the Practical Sessions de projet *0.33

ENERGIES RENOUVELABLES

RENEWABLE ENERGY SYSTEMS

Lecturers: Eric VINCENS

| Lecturers : 22.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Our excessive dependence on fossil fuels to think of the building differently for greater sustainability. The idea of an autonomous or positive energy building is now a reality thanks to a better integration of renewable energy sources. The operation, integration and use of these sources used alone or in combination will be developed and illustrated through examples.

Keywords : heat pump, diagnosis, solar and photovoltaic panels

Programme

- Heat pump: CM 4h
- Photovoltaic - thermal panels: CM 6h
- Diagnosis and energy performance of the Habitat: CM 12h

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Bruno Béranger, *LES POMPES À CHALEUR*, Eyrolles Environnement, 2013
Anne Labouret, Michel Villoz *ÉNERGIE SOLAIRE PHOTOVOLTAÏQUE*, Dunod, 2009
Peuser Felix, Remmers Karl-Heinz, Schnauss Martin*INSTALLATIONS SOLAIRES THERMIQUES - CONCEPTION ET MISE EN OEUVRE*, Observ'er, 2005

Assessment

Continuous evaluation

PROJET TET

GBD PROJECT

Lecturers: Eric VINCENS, Pietro SALIZZONI

| Lecturers : 0.0 | TC : 0.0 | PW : 80.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The option project is common to the three streams. It is based on the final project of the students' diploma from the National School of Architecture of Lyon involved in a master's degree in "Eco-constructive and Architecture Transitions ". Through this interdisciplinary work between student-architects and student-engineers, the goal is to get engineering students to invest in a reflection on economically viable solutions, adapted to a Post-Carbon Society taking into account the scarcity of resources, the necessary energy frugality in a regenerated city.

Keywords : home comfort, structures, foundation engineering, pollution, LCA, circular economy

Programme

- Réflexion sur différentes thématiques à l'échelle de l'Habitat et de la Ville incluant la lithosphère, l'hydrosphère et l'atmosphère
- 3 réunions de suivi de projets par thématique

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Marie-Hélène Contal, Jana Revedin, *ARCHITECTURES DURABLES : UNE NOUVELLE ÉTHIQUE POUR L'ARCHITECTURE ET LA VILLE*, Le Moniteur Editions, 2009
Laurence Lestel, Catherine Carré *LES RIVIÈRES URBAINES ET LEUR POLLUTION*, Quae, 2017
Jean-Jacques Terrin*VILLES ET CHANGEMENT CLIMATIQUE : ÎLOTS DE CHALEUR URBAINS*, Parenthèses, 2015

Assessment

0.33 * oral defense + 0.33 * final written report + 0.33 * 2 interim reports

UE SECTEUR

Option Informatique

UE SECTEUR

Modules Spécifiques
Option Informatique

INFORMATIQUE

COMPUTER SCIENCE AND COMMUNICATION

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

TECHNOLOGIES INFORMATIQUES DU BIG DATA

JAVA ARCHITECTURES FOR INFORMATION SYSTEMS

Lecturers: Daniel MULLER, Mohsen ARDABILIAN, Stéphane DERRODE

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

In many scientific fields, such as biology or environmental sciences, the rapid evolution of scientific instruments, as well as the intensive use of computer simulation, has led to a significant production of data in recent years. Scientific applications are now facing new problems related to the storage and use of these large volumes of data. The problem is much the same for the management of data collected by social networks, this time with the objective of commercial optimization.

The proposed teaching will allow students to discover 3 major technologies emblematic of big-data processing

Keywords : Big Data, NoSQL, MongoDB, Hadoop, Spark, python

Programme

- 3 sessions of 2 hours each on MongoDB, Hadoop and Spark.
- 3 sessions of 4 hours of practical works on MongoDB, Hadoop and Spark.
- 1 practical work session of 2 hours on Spark MLlib.

Learning outcomes

- - Know how to manipulate No-SQL databases with MongoDB
- - Know how to write a map-reduce algorithm with Hadoop with Python, in an HDFS storage environment.
- - Know how to write a Spark algorithm with Python, in an HDFS storage environment.

Independent study

Objectifs : The pratical works are essentially in autonomy. Additional work is required to write the reports.

Méhodes :

Core texts

Assessment

The average of marks obtained on the reports of 3 practical works.

LES SYSTÈMES D'INFORMATION PAR LA PRATIQUE

SOFTWARE ENGINEERING

Lecturers: Daniel MULLER, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

In the job market, the information systems (IT or IT) professions are facing a shortage of talent. Finding and keeping these specific technological talents is a headache for companies around the world. The latter seek engineers capable of understanding the complexity of operations at the business, organizational and social levels, and possessing advanced technical skills. This training action aims to present with a practical approach the information systems present in companies, as well as High Availability principles and techniques.

Keywords : IS/IT (information system), ERP, IMSP (integrated management software package), ISS (security), governance, process, IS/IT architecture, HA (High Availability)

Programme

This training action completes the MOD of Business Information Systems.

Management of IS Project – 4H
Functional and applicative functions of an ERP – 4H
Technical and security management principes – 4H

Due to the complexity of ERPs, a case study of 4 hours will allow students to get a first approach on them.

Learning outcomes

- Understand the key principles behind an ERP (ERP)
- Follow a project to implement an ERP from beginning to end
- Analyse the basic principles of information systems security
- Know about HA implications.

Independent study

Objectifs :

Méhodes :

Core texts

J-L Tomas, Y. Gal., *ERP ET CONDUITE DES CHANGEMENTS.* , Dunod., 2011
J-L Deixonne. *PILOTER UN PROJET ERP.*, Dunod., 2011
F. Pinckaers, G. Gard inier. *OPENERP POUR UNE GESTION D'ENTREPRISE EFFICACE ET INTÉGRÉE.* , Eyrolles., 2008

Assessment

The final evaluation, MCQ, and the score of the case study.

INTERNET DES OBJETS ET SYSTÈMES CONCURRENTS EMBARQUÉS

INTERNET OF OBJECTS AND EMBEDDED CONCURRENT SYSTEMS

Lecturers: René CHALON, Alexandre SAIDI

| Lecturers : 12 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8 | Project : 0.0 | Language : FR

Objectives

The Internet of Things is based on the continuous progress of microelectronic and network technologies that allow the deployment of distributed services on networks of interconnected communicating objects.

This module will first provide an overview of the Internet of Things, from the norms, standards and technologies on which it is based, to the applications and security issues.

In a second step, the students will be made aware of the notions of concurrent programming as well as of real-

Keywords : Internet of Things, Web of Things, connected devices, smart city, Ambiant Intelligence, home automation, Bluetooth, Zigbee, 6LoWPAN, PLC, Concurrent programming, Real-time computing, Embedded computing, Mobile computing

Programme

- Context, uses and fields of application of IoT: smart cities, ambient intelligence, Big Data (2h)
- Technologies of connected objects (2h)
- Security and physical safety of connected objects (2h)
- Network aspects and identification of objects (2h)
- Notions on concurrent programming, mutual exclusion mechanisms, concurrent schemes (2h)
- Requirements of real time systems and kernels, embedded and mobile computing, robotics (2h)

Learning outcomes

- Understand the field of connected objects, their technologies and applications as well as the notions of concurrency/parallelism.
- Design an application based on the exploitation of data from distributed sensors
- Simulations of concurrent systems for handling and processing data from multiple sensors

Independent study

Objectifs :

Méhodes :

Core texts

N. Bouhaï et I. Saleh , *INTERNET DES OBJETS, ÉVOLUTIONS ET INNOVATIONS*, ISTE editions, 2017
M. Yaynal *CONCURRENT PROGRAMMING: ALGORITHMS, PRINCIPLES, AND FOUNDATIONS*, Springer-Verlag, 2013
A. Burns & A. Wellings*CONCURRENT AND REAL-TIME PROGRAMMING IN ADA*, Cambridge U. Press, 2007

Assessment

Final mark = 50% Knowledge + 50% Know-how
Knowledge N1 = 100% final exam
Know-how N2 = 100% continuous assessment

APPRENTISSAGE AUTOMATIQUE

MACHINE LEARNING

Lecturers: Emmanuel DELLANDREA, Liming CHEN, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Deep learning has revolutionized an increasing number of domains, e.g., computer vision, natural language processing, games, etc. Structured learning is machine learning which aims to output data, e.g., sequences, matrix, graphs, which have components under some dependencies, e.g., words in a sentence. In this course, we aim to introduce fundamental concepts, theories and advanced techniques in deep structured learning, covering in particular sequence to sequence learning and Generative Adversarial Network (GAN). A number of practical works will be scheduled, including for instance image generation, image to text generation, text-to-image generation, style transfer, etc.

Keywords : Structured learning, recursive networks, LSTM, Attention-based models, Transformer, Bert, GAN

Programme

Sequence to sequence learning
- Recursive Network, LSTM, GRU
- Attention-based Model
- Transformer
- Language models, ELMO, BERT, GPT

Generative Adversarial Network (GAN)
- Basics
- Conditional GAN

Learning outcomes

- Understand the basic principles of deep structured learning
- Know how to implement state of the art techniques and methods, e.g., LSTM, Transformer, and GANs, for practical structured learning problems
- know how to evaluate the quality of an implemented deep structured learning method

Independent study

Objectifs :

Méhodes :

Core texts

C. M. Bishop. , *PATTERN RECOGNITION AND MACHINE LEARNING.* , Springer., 2006
Goodfellow, Y. Bengio, and A. Courvill e. *DEEP LEARNING.* , MIT Pres., 2016

Assessment

Final exam and scores of BE

VISION PAR ORDINATEUR

PROJECT

Lecturers: Mohsen ARDABILIAN, Liming CHEN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Computer vision aims to model and automate the visual recognition process by the machine and has many applications (e.g., industrial inspection, robotic navigation, human-machine interaction, etc.). This course introduces the key concepts and techniques of the field and covers the following topics: image formation and filtering, contour detection and segmentation, local descriptors and their matching, stereovision, movement and structure estimation, detection and recognition of objects.

Keywords : Image Filtering and processing, edge detection and segmentation, local descriptors, motion tracking, stereo vision, object detection and recognition

Programme

- Introduction to Computer Vision
- Reminders on image formation and filtering, contour detection by variational techniques
- Reminders on homogeneous coordinates and geometric transformation
- Projective Geometry
- Segmentation of images and objects
- Local Feature's Descriptors and Matching
- Movement tracking and structure estimation
- Camera Calibration and Stereo Vision
- Object detection and recognition

Learning outcomes

- Understand the process of image formation and stereovision
- To be able to implement fundamental techniques to improve and process images
- Develop vision applications for the detection of simple objects

Independent study

Objectifs :

Méhodes :

Core texts

D. Forsyth, J. Ponce., *COMPUTER VISION -- A MODERN APPROACH.*, Prentice Hall., 2002
R. Szeliski. *COMPUTER VISION -- ALGORITHMS AND APPLICATIONS*, Springer, 2010
R. Hartley, A. Zisserman.*MULTIPLE VIEW GEOMETRY IN COMPUTER VISION.*, Cambridge University Press, 2004

Assessment

The final test and scores of BE

CALCUL ET MODÉLISATION GÉOMÉTRIQUE POUR L'INFORMATIQUE GRAPHIQUE

CALCUL ET MODÉLISATION GÉOMÉTRIQUE POUR L'INFORMATIQUE GRAPHIQUE

Lecturers: Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The popularization of 3D digitization techniques has led to the development of complex digital object models. It is indeed essential to benefit from efficient and fast treatments to obtain, transmit, edit and deform quality models that are produced from raw data that may be very noisy and redundant. The purpose of this course is to introduce the notion of Geometry Processing useful for shape modeling.
In particular, we will examine the problem of generating a surface mesh as a discretization of the geometry of a 2D or 3D shape, and we will present the approaches of Computational Geometry to generate, simplify, refine and manipulate them, by relying on geometric structures. with particular properties.

Keywords : Geometry processing, mesh generation, 3D reconstruction, mesh simplification and refinement, Techniques based on Delaunay triangulation and Voronoi diagram, virtual sculpture.

Programme

Meshes:
- Definitions
- Generation of meshes, 3D reconstruction and virtual sculpture
- Simplification and refinement of meshes
- Meshes improvement, coding

Geometry Processing and Computational Geometry (CG):
- Elementary notions of CG in 2D (planar maps, graphs, triangulation, convex hull)
- Construction of convex hull in 2D: optimal algorithm (divide and conquer)

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Pascal Frey, Paul-Louis George, *MESH GENERATION*, 2nd Edition. Wiley-ISTE, 2008
Mario Botsch, Leif Kobb elt, Mark Pauly, Pierre Alliez, Bruno Levy *POLYGON MESH PROCESSING*, K Peters/CRC Press, 2011
M. de Berg, M. van Kreveld, M. Overmars, O. Schwar*COMPUTATIONAL GEOMETRY ALGORITHMS AND APPLICATIONS*, Springer-Verlag, 1997

Assessment

Final evaluation and score of the BE

APPRENTISSAGE BAYÉSIEN ET EXPLORATION DE TEXTES

BAYESIAN MACHINE LEARNING AND TEXT MINING

Lecturers: Alexandre SAIDI, Stéphane DERRODE

| Lecturers : 10 | TC : 4 | PW : 0.0 | Autonomy : 0.0 | Study : 6 | Project : 0.0 | Language : FR

Objectives

We will focus on the family of Bayesian methods, which is distinguished by its optimality in the sense of certain criteria, by its reduced cost from an algorithmic point of view and by the interpretability of its results. We will also study the solutions available to the data scientist when the learning sample is small in relation to the number of parameters to be learned, or when the learning must be done in an unsupervised manner. In terms of application, we will focus on the exploration of a textual corpus to discover, for example, new customers eligible for the sale of a service/product, to predict the feelings (opinions) of customers or to understand the behaviours that predict fraud.

Keywords : Bayesian decision theory, Unsupervised learning, Hidden Markov models, Text mining, Sentiment analysis, Chatbot, Natural Language Processing, Automatic translation.

Programme

- Bayesian decision (2h)
- Gaussian mixture model (2h)
- Hidden Markov chain (2h)
- Practical work on Bayesian learning (2h)
- Computational linguistic, NLP and practical Text Mining (8h)
- Restitution of a scientific reading by group (4h)

Learning outcomes

- Select the appropriate ML method(s) for their classification problem, considering different criteria.
- Develop programs using these methods to analyze their own data.
- Implement a processing chain to interpret texts (e.g. tweet).
- Become familiar with modern text mining techniques and tools and Read recent research papers on the topics mentioned.

Independent study

Objectifs : The students, divided into groups, will have to read and understand a scientific article on one of the subjects covered in the course. The articles will be proposed by the supervisors or by the students (after agreement with the supervisors).

Méhodes : The work will be done independently and the oral presentation will take place during a group presentation session.

Core texts

M. R. Gupta and Y. Chen, • *THEORY AND USE OF THE EM ALGORITHM*, Foundations and Trends in Signal Processing, Vol. 4(3), pp. 223–296, 2011
M. Watanabe and K. Yamaguchi *THE EM ALGORITHM AND RELATED STATISTICAL MODELS* , Statistics: Dekker series of textbooks and monographs, 2004
Michael W. Berry, Jacob Kogan*TEXT MINING: APPLICATIONS AND THEORY*, Willey, 2010

Assessment

Grade = 50% knowledge + 50% know-how
Knowledge mark = 100% final exam
Know-how mark = 50% for practical and 50% scientific paper restitution

PROJET INFORMATIQUE

PROJECT

Lecturers: Daniel MULLER, Mohsen ARDABILIAN

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

From January to the end of March, students work in teams of four on a project of their choice.
Working sessions are scheduled every Thursday morning to work on these projects.
Two reporting-sessions in January and February and a final presentation of deliverables in March are planned to assess students work.

Keywords :

Programme

From January to the end of March, students work in teams of four on a project of their choice.
Working sessions are scheduled every Thursday morning to work on these projects.
Two reporting-sessions in January and February and a final presentation of deliverables in March are planned to assess students work.

Learning outcomes

- To be able to specify, design and officer innovative projects in the digital world, in the context of increasingly complex systems.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Two reporting-sessions and a final presentation of the deliverables, appreciated by the sponsors, tutors and pedagogical team.

UE SECTEUR

Filière Informatique

UE SECTEUR

Option Transport et Trafic

UE SECTEUR

Spécifiques Option Transport et Trafic

UE SECTEUR

Filière Trafic et Environnement

TRAFIC ET ENVIRONNEMENT

TRAFFIC AND ENVIRONMENT

Lecturers: **Olivier BAREILLE**

| Lecturers : 18.0 | TC : 2.0 | PW : 50.0 | Autonomy : 0.0 | Study : 18.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

TRANSPORTS ET SOCIÉTÉ

LAND TRANSPORT AND SOCIAL PRIORITIES

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

INGÉNIERIE DES TRANSPORTS

TRANSPORTATION ENGINEERING

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

SÉCURITÉ DES TRANSPORTS

TRANSPORTATION SAFETY

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

LOGISTIQUE DESTRANSPORTS

TRANSPORT LOGISTICS

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PROJET TT

TT PROJECT

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

VISITES DE SITES

TRANSPORTATION NOISE

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

UE SECTEUR

Filière Technologies des Véhicules

TECHNOLOGIES DES VÉHICULES

VEHICLE TECHNOLOGIES

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

TRANSPORTS ET SOCIÉTÉ

LAND TRANSPORT AND SOCIAL PRIORITIES

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

INGÉNIERIE DES TRANSPORTS

TRANSPORTATION ENGINEERING

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

DYNAMIQUE DES VÉHICULES

COMBUSTION ENGINE AND HYBRID

Lecturers: Olivier BAREILLE

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

ORGANES ET ARCHITECTURE VÉHICULE

VEHICLE TECHNOLOGIES

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PROJET TT

TT PROJECT

Lecturers: **Olivier BAREILLE**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

VISITES DE SITES

TECHNOLOGICAL INNOVATIONS

Lecturers: **Mohammed ICHCHOU**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment