



Guia docent (provisional) TM – Aircraft Trajectory Management

Última modificació: 14/05/2021

Unitat responsable: Escola d'Enginyeria de Telecomunicació i Aeroespacial de Castelldefels
Unitat que imparteix: 748 - FIS - Departament de Física.

Titulació: MASTER EN ENGINYERIA AERONÀUTICA (Pla 20XX). (Assignatura obligatòria).

Curs: 2021 **Crèdits ECTS:** 5.0 **Idiomes:** Anglès

PROFESSORAT

Professorat responsable: Xavier Prats Menéndez

CAPACITATS PRÈVIES

Previous concepts include knowledge of flight mechanics, control and guidance, and air traffic management, given in any bachelor's degree in aerospace engineering and reviewed in previous subjects of this Master's degree, as well as familiarity with the use of computing tools for engineering. Familiarity with Python and/or Matlab is required.

REQUISITS

Concepts seen in 220309 - Transport Aeri i Sistemes de Navegació
(https://www.upc.edu/estudispdf/guia_docent.php?codi=220309&idioma=en)

COMPETÈNCIES DE LA TITULACIÓ A LES QUALS CONTRIBUEIX L'ASSIGNATURA

Específiques:

CEEaeronav1: Optimizar, predecir o simular las trayectorias de las aeronaves en cualquier fase del vuelo, a partir del análisis de sus prestaciones y el medio operacional y físico en el que se desenvuelven.

Genèriques:

Transversals:

METODOLOGIES DOCENTS

The course combines the following teaching methodologies:

- Theoretical lectures.
- Autonomous learning: students will study using self-learning material.
- Cooperative learning: students will form small group (2-4 people) to fulfill some of the activities of the course.
- Project based learning: students will build a small team project (3-4 people).

Directed learning hours will consist in exercises and practical examples, after the theory classes in which the lecturer exposes the content of the subject. With the directed learning hours, the students will be motivated to participate actively in their education and to complete the knowledge acquired during theory classes, usually with the help of computers.

OBJECTIUS D'APRENTATGE DE L'ASSIGNATURA

This course focuses on the mathematical computation and modelling of aircraft trajectories. Different types of aircraft will be considered, such as airliners, gliders or aerobatic airplanes, helicopters or rocket launchers. The course covers the whole lifecycle of an aircraft trajectory computation, from its design (and optimization) to the selection of the guidance commands for the (auto)pilot. At the end of the course, the student will be able to:

- . model the dynamics of an aircraft with a three-degree-of-freedom model;
- . identify the different sources of uncertainty affecting the modelling and execution of aircraft trajectories;
- . understand the concepts of flight intent, aircraft intent, and guidance modes;
- . identify the principal components and functionalities in modern automatic-flight systems and trajectory computation ground-based tools.

HORES TOTS DE DEDICACIÓ DE L'ESTUDIANTAT

Tipus	Hores	Percentatge
Hores aprenentatge autònom	80,0	64.00
Hores grup gran	15,0	12.00
Hores grup petit	30,0	24.00

Dedicació total: 125 h



CONTINGUTS

Introduction

Descripció:

- Introduction to trajectory modelling and review on flight mechanics and aircraft performance.
- Three-degree of freedom models for aircraft dynamics
- Trajectory uncertainty modelling and quantification
- Overview on trajectory prediction, optimization, guidance, control and simulation.

Dedicació: 12h

Grup gran/Teoria: 2h

Grup petit/Laboratori: 4h

Aprenentatge autònom: 6h

Use cases and review on trajectory management systems.

Descripció:

Overview, description and literature review on:

- Flight dispatching tools
- Flight management and guidance systems.
- Other on-board applications in electronic flight bags (EFB).
- Air/ground trajectory synchronization.
- Air traffic control decision support tools (AMAN, DMAN, ...)
- Aircraft separation and safety nets (MTCD, STCA, ACAS, ASAS, ...)
- Flight simulation.

Dedicació: 12h

Grup gran/Teoria: 2h

Grup mitjà/Pràctiques: 4h

Aprenentatge autònom: 6h

Project I: trajectory prediction and optimisation

Descripció:

Working in groups, the students will select a trajectory prediction and/or optimisation challenge among a list of topics proposed by the lecturer, which will cover different use cases and types of aircraft and trajectory missions. The students will develop an algorithm to predict and/or optimize trajectories to address the particular challenge. A report will be delivered and a presentation summarizing the achievement will be given in front of the rest of students.

Dedicació: 55h

Grup gran/Teoria: 6h

Grup petit/Laboratori: 12h

Aprenentatge autònom: 37h



Project II: Trajectory guidance and simulation

Descripció:

As a continuation of the first part of the project, the students will develop a small guidance and simulation software to validate the Algorithm developed in the first part of the project. A report will be delivered and a presentation summarizing the achievement will be given in front of the rest of students.

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Dedicació: 46h

Grup gran/Teoria: 5h

Grup petit/Laboratori: 10h

Aprenentatge autònom: 31h

SISTEMA DE QUALIFICACIÓ

Participation in class and exercises: 10%

Individual exams and tests: 35%

Projects and presentations: 55%