

# Asignatura : Informática

## Grado en Ingeniería Aeroespacial - ETSIAE

### Subjects for the P3 assignment:

1. Catastrophic cancellation in numerical computations. Application to specific problems such as roots of a second grade equation.
2. Internal representation of numbers. Standard IEEE. IEEE exceptions. How to detect problem: underflow, overflow.
3. Ill posed problems and stability.
4. History of Fortran language with code examples. From Hidden Figures to our days.
5. Emergent behavior: flocking, ants, society.
6. Games: SUDOKU, ...
7. Functional programming. John Backus contributions. Declarative (functional paradigm) versus imperative (von Neumann style, "word at a time" paradigm). Lazy evaluation. Expressiveness. Data abstraction. Map, filter and reduce.
8. Determinant of a matrix using the Laplace expansion by means of a recursive function:

$$\det(A) = \sum_{j=1}^N (-1)^{i+j} a_{ij} M_{ij},$$

where  $M_{ij}$  stands for the determinant of a  $(N-1) \times (N-1)$  matrix by removing  $i$ th row and  $j$ th column.

9. Application to visualize Taylor expansion convergence at different points. Implement a friendly graphical user interface to analyze and to understand convergence pitfalls.
10. Dynamic web page to plot Kepler orbits.

The program of the P3 assignment can be implemented in Python, FORTRAN, C++ or JavaScript.

### General contents of P3 assignment:

1. Objective.
2. State of art.
3. Explanation through programming codes.
4. Conclusions.
5. References.