Linear algebra

ECTS : 3

Volume horaire : 18

Description du contenu de l'enseignement :

To provide a working understanding of matrices and vector spaces for later modules to build on and to teach students practical techniques and algorithms for fundamental matrix operations and solving linear equations.

Compétence à acquérir :

By the end of this module, students will have demonstrated: **Knowledge**

1. The understanding algebraic and geometric representations of vectors in R^n and their operations
2. The ability to define a linear combinaision, a dependant, independent and spanning set of vectors
3. The ability to define subspace of a vector space, recognize and use basic properties of subspaces and vector spaces
4. The ability to recognize echelon forms, to identify the number of pivots and to interprete the result
5. The ability to define the size of a matrix, the inverse of a matrix, the transpose of a matrix
6. The ability to provide a definition of the determinant and describe its properties (including the determinant of the inverse, the transpose, the determinant of a product, the determinant of an upper/lower triangular matrix)
7. The ability to describe how performing row operations affects the determinant
8. The ability to recognise a basis of the vector space Rn and describe coordinates of a vector relative to a given basis
9. The ability to define the Image and the Kernel of a vector space and state the rank-nullity theorem
10. The ability to define, give examples, and properties of the eigenvectors and eigenvalues

Skills

1. The ability to determine whether or not particular subsets of a vector space are subspaces
2. The ability to perform row operations on a matrix and solve systems of linear equations using Gauss-Jordan elimination to reduce to echelon form
3. The ability to perform common matrix operations such as addition, scalar multiplication, multiplication (when possible), and transposition
4. The ability to solve linear systems of equations using the language of matrices and solve systems of linear equations using the inverse of the coefficient matrix when possible
5. The ability to compute the inverse of a matrix using Gauss elimnination
6. The ability to compute the determinant of a two-by-two matrix or three-by-three matrix and the determinant of a matrix n x n via formula involving recuding to a determinant of size (n-1) x (n-1)
7. The ability to determine a basis, the dimension and the equations of a finite-dimensional space in particular the Image and the Kernel of a matrix (using the rank nullity theorem if need be).
8. The ability to determine the eigenvalues and eigenvectors of a matrix and use characteristic polynomials to compute eigenvalues and eigenvectors and, when possible diagonalize a matrix.
9. The ability to use diagonal matrix to solve systems involving sequences of vectors or power of matrices.

Values and Attitudes

1. Ability to articulate deductive reasoning
2. Rigor in reasoning and notation