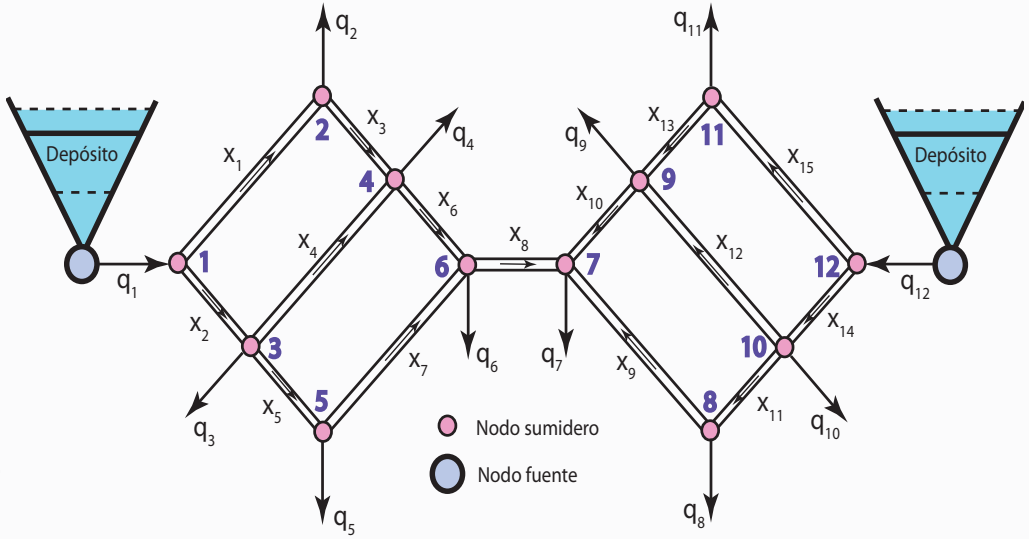
Algebra I

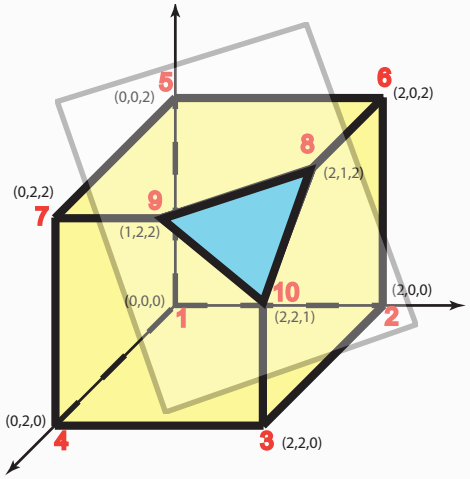
Enrique Castillo Ron
Universidad de Castilla-La Mancha

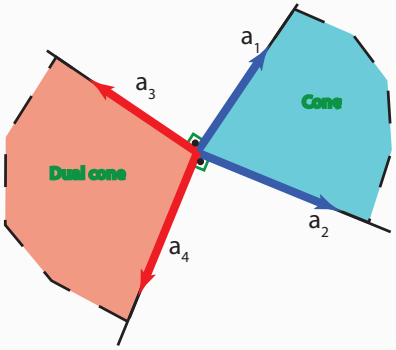
Royal Academy of Engineering

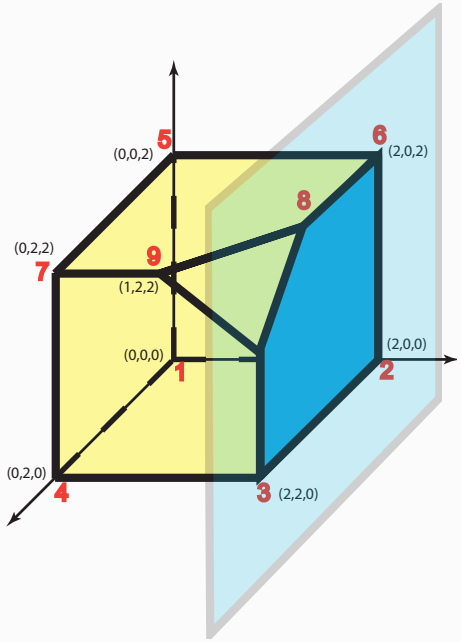
Royal Academy of Sciences

Enrique Castillo









Introduction and Motivation

Algebra

This course presents, the orthogonalization algorithm, that was invented by Francisco Jubete Portilla, a Civil Engineering Ph. D. with whom I had the pleasure to work some years to get to discover a good part of what is presented in this course.

The rest, is the result of 20 years teaching the course at the School of Civil Engineering of the Castilla-La Mancha University in Ciudad Real, whose students, with their enthusiasm, support and suggestions, motivated me to create this course and publish it in Internet.

The algorithm is presented, in just five minutes, and with it we can solve all the problems of classical linear algebra.

ORTOGONALIZATION ALGORITHM

- Update inverse of a matrix
- Obtain inverse of a matrix
- Subspace vector membership
- Obtain the orthogonal subspace to a given subspace
- Obtain the rank of a matrix by a new method
- Obtain intersection of two subspaces
- Analyze the compatibility of a system of equations
- Solve all subsystems of a given linear system
- Solve system of Equations
- Obtain the determinant of a matrix by a new method

In particular you will see:

1. How to get the subspace orthogonal to a given subspace and its complement subspace.
2. How to calculate the inverse of a matrix.
3. How to update the inverse of a matrix after changing a row or column.
4. How to obtain the determinant of a matrix.
5. How to update the determinant of a matrix after changing a row or column
6. How to determine the rank of a matrix.
7. How to determine if a vector belongs to a linear space.
8. How to obtain the subspace intersection of two subspaces.
9. How to solve a homogeneous linear system of equations.
10. How to solve a complete linear system of equations.
11. How to study the compatibility of a linear system of equations.