

# System of linear equations

Numerical methods used to solve such problem allow to introduce and experiment on [Time\\_complexity](#), considering cubic time behavior of standard algorithms and *i.e.* quadratic time solutions using LU decomposition.

## Theory

- [System\\_of\\_linear\\_equations](#)
- [Gaussian\\_elimination](#), Gauss and Gauss-Jordan eliminations (diagonalization, triangularization)
- [Pivot\\_element](#), pivoting
- [LU\\_decomposition](#)
  - [Triangular\\_matrix#Forward\\_and\\_back\\_substitution](#)
- Time complexity analysis
  - Hint : in Python, use the timeit module

## Applications

### 1D problems with neighbours

- Thermal diffusion and chemical diffusion (transient or stationary) on a regular 1D space with equidistant steps. ODE equations can be written such a given evolution equation for node #  $i$  only implies nodes  $i+1$  and  $i-1$
- Using Thomas algorithm allows to save computational time thanks to  $n$  complexity

## References :

- Numerical recipes, The Art of Scientific Computing 3rd Edition, William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, 2007, isbn: 9780521880688
  - <http://numerical.recipes/>
  - [http://www2.units.it/ipl/students\\_area/imm2/files/Numerical\\_Recipes.pdf](http://www2.units.it/ipl/students_area/imm2/files/Numerical_Recipes.pdf)
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Last update: **2017/09/28 10:34**

