

Numerical Linear Algebra - Notes - v0.1.0-dev

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Preface

Every theory section in these notes has been taken from the sources:

- Course slides. [\[1\]](#)

About:

 [GitHub repository](#)

These notes are an unofficial resource and shouldn't replace the course material or any other book on numerical linear algebra. It is not made for commercial purposes. I've made the following notes to help me improve my knowledge and maybe it can be helpful for everyone.

As I have highlighted, a student should choose the teacher's material or a book on the topic. These notes can only be a helpful material.

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1 Preliminaries

This section introduces some of the basic topics used throughout the course.

1.1 Notation

We try to use the same notation for anything.

- **Vectors.** With \mathbb{R} is a set of real numbers (scalars) and \mathbb{R}^n is a space of column vectors with n real elements.

$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix}$$

Vectors with all zeros and all ones:

$$\mathbf{0} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix} \quad \mathbf{1} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$$

- **Matrices.** With $\mathbb{R}^{m \times n}$ is a space of $m \times n$ matrices with real elements:

$$\mathbf{A} = \begin{bmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\ \vdots & & & \\ a_{m,1} & a_{m,2} & \cdots & a_{m,n} \end{bmatrix}$$

Identity matrix $\mathbf{I} \in \mathbb{R}^{n \times n}$:

$$\mathbf{I} = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ 0 & 1 & \cdots & 0 \\ \vdots & & & \\ 0 & 0 & \cdots & 1 \end{bmatrix} = [\mathbf{e}_1 \quad \mathbf{e}_2 \quad \mathbf{e}_n]$$

Where \mathbf{e}_i , $i = 1, 2, \dots, n$ are the canonical vectors.

$$\mathbf{e}_i = [0 \quad 0 \quad \cdots \quad 1 \quad \cdots \quad 0 \quad 0]^T$$

Where 1 is the i -th entry.

References

- [1] Antonietti Paola Francesca. Numerical Linear Algebra. Slides from the HPC-E master's degree course on Politecnico di Milano, 2024.