Part I
Introduction to Linear Algebra

We're already familiar with elementary algebraic objects: numbers (or scalars), along with the arithmetic operations between them. In this part, on the other hand, we look at more complicated structures: vector and matrix. Fortunately, it is also possible to define arithmetic (or algebraic) operations between them.

With these new operations, the vectors make a new linear space. The (nonsingular) matrices, on the other hand, make yet another important structure: a group. In a group, the associative law must hold. The commutative law, on the other hand, not necessarily holds.

The matrix is not just an algebraic object. It may also have a geometrical meaning: a mapping or transformation. This is most useful in many applications.

In special relativity, for example, the Lorentz transformation can be written as a small 2×2 matrix. In geometrical mechanics, on the other hand, 3×3 matrices are more useful. Finally, a yet bigger matrix is often used in stochastic analysis, to model a Markov chain in a graph. This has an interesting application in modern search engines in the internet.