A Hypertext on Linear Algebra

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Mathematical writing on the Web has largely followed the standard forms of print: papers, journals, lecture notes, encyclopedias. A hypertext is an alternative form of mathematical writing which tries to combine the wide reach and associativity of the Web with the depth and cohesion needed for learning mathematics. A hypertext on linear algebra is online and at the first stage of development. The main portion of the hypertext consists of three longer texts, which each covers a different aspect of linear algebra. These texts link to auxiliary text of different sorts: independent entries of the main theorems of linear algebra, discussions on a particular theme, supporting text on a proof or technique. We describe the structural and visual design of the text and present an online tour of the linear algebra hypertext.

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Mathematics Hypertext Project
http://alpha.fdu.edu/~mayans/mhp_home.html

Foundational paper: “The future of mathematical text”,
http://jodi.ecs.soton.ac.uk/Articles/v05/i01/Mayans/

Collaborators and contributors are sought for every aspect of this project.
A HYPERTEXT ON LINEAR ALGEBRA
Prototype of a large-scale system of mathematical text
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ABOUT THE PROJECT

Goal of the Mathematics Hypertext Project:
• To create large-scale integrated structures of mathematical text.

What is a hypertext?
• A collection of linked Web pages with a common structure, design, and editorial conventions.

Why a hypertext?
• A dynamic text is a natural organization for mathematics
• Advancing, improving, correcting, and reorganizing text all part of mathematical work
• Embraces the intellectual unity of mathematics as well as its diversity of subjects

Why linear algebra?
• Linear algebra holds a central position in mathematics, with strong ties to abstract algebra, functional analysis, multivariate calculus, differential equations, and with an enormous range of applications.

Where is it on the Web?
• Google on "Mathematics Hypertext Project". Start at the page: "Setting up your browser".

When will it be done?
• The portion on the map will be completed by the end of 2006.

Who’s working on it?
• Not enough people!
• We earnestly seek collaborators, designers, experts, students, Web whizzes, and mathematicians of every persuasion to design and develop the text.
• Contact mayans@fdu.edu

A MAP OF THE TEXT

Systems of Linear Equations
• Systems of linear equations
• Solution by Gaussian elimination

Linear Algebra in \( \mathbb{R}^n \)
• Vectors in \( \mathbb{R}^n \)
• Subspaces of \( \mathbb{R}^n \)
• Inner product and norm
• Linear independence, basis
• Geometry in \( \mathbb{R}^n \)
• Systems of linear equations
• Matrices and linear transformations
• Noncommutative matrix multiplication

Introduction to Vector Spaces
• Introduction
• Axioms of a vector space
• Examples of a vector space
• Subspaces and spans
• Linear transformations and duality
• Direct products
• Quotient spaces

Core Text
Discussion of a single theme
Associative linking

Book Text
Progression of ideas
Linear, tree-like linking

Inner Link
Returns to start point

Outer Link
No return to start point

TECHNOLOGIES
• Use of WWW standards: MathML for mathematics, SVG for graphics
• Easy, free setup for Internet Explorer and Netscape
• Use of Javascript tools, ASCIIMathML and ASCIIsvg, designed by Prof. Peter Jipsen, Chapman University
• Easy to write mathematical text.
• Example: \( e^x = 1 + x + x^2/2 + \cdots \) prints as expected.

BIBLIOGRAPHY
• Paul Halmos, Finite Dimensional Vector Spaces
• Peter Lax, Linear Algebra
• David Lay, Linear Algebra and Its Applications