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Linear algebra.

Springer Undergraduate Mathematics Series. Cham: Springer (ISBN 978-3-319-24344-3/pbk; 978-3-319-24346-7/ebook). xi, 324 p. (2015).

This book is a translation of the second edition of the authors' German version [Heidelberg: Springer Spektrum (2015; Zbl 1305.15002)]. It provides a good introductory undergraduate course at an intermediate level which the authors describe as: "matrix-oriented, ... presenting a rather complete theory (including all details and proofs) while keeping an eye on the applicability of the results". The first third of the book restricts itself to matrices and covers standard topics such as: solution of linear equations, Gaussian elimination and echelon form; determinants; eigenvalues, eigenvectors and the Cayley-Hamilton theorem. This is done is a concrete and classical way. From this point on, the material becomes more abstract: abstract vector spaces and linear transformations; bilinear forms; Euclidean and unitary spaces; adjoint endomorphisms; Schur triangularization; the Jordan canonical form. The last four chapters of the book deal with functions of matrices and application to differential equations; diagonalization of normal endomorphisms and geometry of Sylvester's law of inertia; the singular value decomposition and image compression; and solution of linear matrix equations using the Kronecker product. The translation reads well and the exposition is clear. From the beginning, the authors motivate the material with interesting examples such as Google's PageRank algorithm (eigenvectors), car insurance (Markov chains) and prediction via least squares, and although the book emphasizes theory rather than computation, the theoretical results are liberally illustrated with simple numerical examples. Computational issues are not directly addressed, but the text includes short "MATLAB-Minutes" which are exercises providing an informal introduction to the use of MATLAB in linear algebra, including hints about how care may be needed when working in finite precision.

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Classification: H65
Keywords: textbook; Gaussian elimination; determinants; eigenvalues; eigenvectors; Cayley-Hamilton theorem; vector space; linear transformation; bilinear form; Euclidean space; unitary spaces; adjoint endomorphisms; Schur triangularisation; Jordan canonical form; functions of matrices; differential equations; Sylvester's law of inertia; singular value decomposition; image compression; linear matrix equations; Kronecker product; Google's PageRank algorithm; Markov chain; least squares; numerical examples
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