

ZMATH 2014b.00582**Petersen, Peter****Linear algebra.**

Undergraduate Texts in Mathematics. Berlin: Springer (ISBN 978-1-4614-3611-9/hbk; 978-1-4614-3612-6/ebook). x, 433 p. (2012).

The five chapters of this text are: 1. Basic theory, 2. Linear operators, 3. Inner product spaces, 4. Linear operators on inner product spaces, and 5. Determinants. The presentation is at the advanced undergraduate level and includes the concepts needed by students who will continue on to graduate studies. Among the topics included are the usual introductory material on real and complex vector spaces, real and complex inner products, the spectral theorem for normal operators, dual spaces, quotient spaces, minimal polynomial, the Jordan canonical form, the Frobenius canonical form, matrix exponentials, and determinants. Given the clear and thorough discussion of inner products, it is a missed opportunity not to have included material on the Fréchet-von Neuman-Jordan theorem relating norms and inner products. The presentation of material in the first four chapters is essentially “determinant-free”. The principal tool to solve systems and calculate eigenvalues is the Gaussian elimination. Throughout the text applications to and connections with linear differential equations are included. In the final chapter, the starting point for the concept of the determinant of a linear operator $L : V \rightarrow V$ is the geometric point-of-view that $\det(L)$ measures how L changes volumes in the vector space V . The discussions and examples are clear, interesting, and appropriately thorough. There are numerous well-chosen exercises to test the readers understanding and, in some cases, to further develop some of the ideas. Although this is an advanced text that is more suitable for a second linear algebra course, it is nevertheless a text that should be included in every undergraduate mathematics library. Even a beginning student will be well-rewarded by exploring various topics in this book. [Minor correction: on page 242 the vertical side of the figure should read $x - \text{proj}_y(x)$].

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Classification: H65

Keywords: real vector space; complex vector space; inner product; spectral theorem; linear operator; dual space; quotient space; minimal polynomial; Jordan canonical form; Frobenius canonical form; matrix exponential; determinant; eigenvalue; eigenvector; linear differential equation; matrix exponential; Gaussian elimination

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