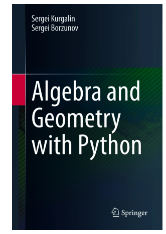
Mini-review of [1]

Algebra and Geometry with Python

by **Sergei Kurgalin & Sergei Borzunov**



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Review by **Mikael Vejdemo-Johansson**
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This is an introduction to elementary linear algebra and analytical geometry with some code snippets and references to performing computations in Python - suitable for a first-year course for STEM students. In the book, a reader will meet most of the topics expected in such a course: matrices, vectors and matrix algebra; matrix reduction to solve systems of linear equations; equations of straight lines and planes; structure of euclidean vector spaces with particular focus on $\mathbb{R}^3$. Towards the end, it goes into a selection of geometric applications of the principles developed earlier in the book: complex numbers, quantum computing, bilinear and quadratic forms with their vector-matrix representations $w(x) = x^T Ax$, generic quadratic curves, and finally even a foray into elliptic curves and their group structure.

Each chapter starts with the text developing the material, with concrete examples and worked calculations. This is followed by a good selection of review questions and then problems that range from mechanic training on the specific skills of the chapter to proof-based and exploratory problems that go into some depth in associated topics that were not covered in the text. They are followed by solutions to most (but not quite all) of the given problems. While making the book better for self-study through this choice, the solutions may decrease the usefulness of the book problems for homework in less trusting academic settings. Index and reference list are solid; no clear or obvious problems with either. The book also includes three appendices: very bare-bones intro to Python, a trigonometry cheat sheet, and the Greek alphabet. The Python appendix gives me the impression that the authors fully expect any reader to already be comfortable with programming.

The quantum computing excursion is more thorough than many short intros that I have seen so far, and it may well set the reader up for reading more thorough introductory texts with more success than without reading this chapter.

As an introduction to linear algebra it is not bad, but the Python connection is both outdated and sporadic at best. The authors give a few code snippets: exchanging values of variables, I/O, matrix addition, scalar multiplication and transposition, matrix multiplication, determinants, Hilbert matrices, Gaussian and Gauss-Jordan elimination, determining quadrant of a point, elliptic curve addition. They are writing the linear algebra Python code without any reference to the matrix multiplication operator (in Python since 2015) - much less any use of it - but since they also barely ever use their own matrix multiplication method, there is not that much lost by skipping it. The authors do say in the Preface that they are using "Python 3" without specifying a sub-version. Most remarkable in how little impact Python has on the book is the entire Section 11.5 with a title starting with "Algorithms" and containing not a single line of either code or algorithm pseudo-code.