My favourite books, papers and scientific software

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Abstract

In this document I decided to assemble various sources of information (books, papers) and also some scientific software libraries which turned out to be extremely useful in the scientific work of the author of these notes. Namely, my vision of some fields of (Applied) Mathematics and Fluid Mechanics has been strongly influenced by these manuscripts. In the past I read far more books and scientific papers. However, only those listed below had the most influential effect on me. As a conclusion, I can strongly recommend to consult these references and absorb the precious fundamental knowledge from them.

The reader will notice that most of my favourite references are rather old. It can be mainly explained by the personal taste of the author of these notes and an additional purely subjective observation: it seems that in older times the quality and information content of the books were much higher...

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Chapter 1

Books

In this part of the document I shall describe the books which influenced and shaped somehow my vision of (Applied) Mathematics and Fluid Mechanics. The majority of these books are written in English. However, some are in Russian or in French. However, in most cases it is possible to find their English translations.

1.1. Calculus

1.2. Advanced calculus

This book is an excellent introduction into the exterior calculus, differential forms and integration theory on manifolds (up to the general form of Stokes theorem). Perhaps, it is the best book to read in the first place to be introduced into the Calculus on manifolds:

- Spivak, M. (1971). *Calculus on Manifolds: A Modern Approach to Classical Theorems of Advanced Calculus*. Princeton: Westview Press.

1.3. Complex analysis

The following book is probably the best course of (advanced) Calculus ever made so far. First of all, there is no separation between the real and complex analysis. Both disciplines live together and enrich each other. The Riemann surfaces are implicitly introduced already in the sixth lesson... The famous interpolation scheme of Hermite can be found there as well with an elegant original proof. Numerous tricks to compute exactly some definite (proper and improper) integrals are also explained in this book along with the study of some special functions. Despite the age of this book, it can be read without any difficulties even today. All notations are modern.

- Hermite, C. (1891). *Cours de M. Hermite rédigé en 1882 par M. Andoyer, élève à l'École Normale* (Quatrième édition, revue et augmentée). Paris: Librairie Scientifique A. Hermannn. 8, rue de la Sorbonne.

1.4. Differential equations

1.4.1 Ordinary Differential Equations

A fairly good and rather short introduction into the theory of ODEs. During many years I. G. Petrovsky was the president of the Moscow State University. His colleagues were A. N. Kolmogorov, I. M. Gelfand and many other brilliant mathematicians. My main motivation to read this book was the desire to take a snapshot of the ODE theory state before V. I. Arnold (Kolmogorov & Moser).

- Petrovsky, I. G. (1984). *Lectures on the theory of ordinary differential equations.* (A. D. Myshkis & O. A. Oleinik, Eds.). Moscow: Moscow University Press (in Russian).

1.4.2 Partial Differential Equations

1.5. Numerical analysis

1.6. Fluid mechanics

1.7. Geometry

1.7.1 Differential Geometry

1.8. Topology

This elementary book on Topology appeared first in German in 1932. P. S. Aleksandrov was a close friend of D. Hilbert and he worked on this manuscript during his stays in Germany (Göttingen). Only later it was translated into Russian and published in the Soviet Union. The particularity of this book is that it describes on an elementary level the state of (a new field by that time) Topology after H. Poincaré and before N. Bourbaki:

- Aleksandrov, P. S., & Efremovich, V. A. (1936). *Outline of the main notions of topology.* Moscow: ONTI — NKTP USSR (in Russian).

Chapter 2

Papers

2.1. Software engineering

And to make a smooth transition to the next part of the document, we discuss some software engineering principles, which are useful in scientific programming.

Chapter 3

Software libraries

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