Not so much official opinions

Customer Reviews

Differential Geometry and Lie Groups for Physicists

Altogether: 2x ★★☆☆☆
1x ★★★★☆
9x ★★★★★

Z.Tan (Californica, USA), www.amazon.com
★★☆☆☆ **not for starter or self-learning**, March 26, 2007

The book covers a good range of topics in Differnetial geometry with lots of exercises. One literarily has to do the exercises to develop the concept. Ecah chapter ends with a concise summary of the key equations. The problem is that all the exercises are mixed with the main context. It lacks any exposition or concept development for most of the topics, no definition, no prove, and every page is filled with exercises. This style make it difficult for someone to learn the subjects the first time or to use it as a reference.

Separately, there are too few graphs to assist the reader to visualize the ideas. The prints are also small making it hard to read.

Nakahara's book (Geometry, topology and physics) is a much better choice on the same subject.

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Michal Tarana (Prague, Czech Republic) www.amazon.com

★★★★★ **Differential geometry**, July 21, 2007

Marian Fecko's textbook covers well fundamental elements of modern differential geometry and introduction to the Lie groups (not only) from geometrical point of view. Geometrical formulations of the classical mechanics, gauge theory and classical electrodynamics are discussed.

The textbook expects the reader to be familiar with mathematical analysis on the level of the standard course usual in the physics undergraduate study programs. Understanding of the parts dealing with physical applications (classical mechanics and electrodynamics) expects knowledge of fundamental principles of these subjects. Organization of the book allows the reader to concern on particular part, i. e. understanding of later parts doesn't require reading of all previous parts (reading of parts concerning on the classical dynamics does not require reading of parts dealing with electrodynamics). However, relations between different subjects of the theory are explained instructively.

The main advantage of this textbook is that reader "builds" the subject himself by solving the exercises usually appended by hints. It makes all the elements of the theory natural to the reader during study. This way is a little bit more time consuming when compared with other textbooks dealing with this subject. It provides good starting point for study of mathematical aspects of the general relativity and field theories. I recommend this book to everybody who wants to understand fundamental concepts in differential geometry in detail.

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Arkadiusz Jadczyk (Toulouse, France) www.amazon.com

★★★★★ **The best book on the subject**, October 26, 2007

Before discovering the new book my Marian Fecko I thought I know all that I need about differential geometry (I co-authored a monograph on this subject myself). I had my favorite books: Kobayashi-Nomizu, Bishop-Crittenden, Sternberg, Michor, Abraham and some more. Yet "Differential Geometry and Lie Groups for Physicists" was a completely new experience. It is written with a "soul" and covers topics that are important but missing in other books. As I was working on a paper dealing with torsion, I emailed the Author with some of my

ideas and questions and got an instant answer.

Readers looking for explanations and geometrical interpretations of the abstract concepts will certainly find this book irreplaceable. Lie and covariant derivatives, parallel transport, Hodge operator, Cartan's moving frame method, Laplace-Beltrami operator, Lie groups, Maxwell equations, Clifford algebras and spin bundles, SL(2,C), Dirac operator, Momentum map etc. etc. - all introduced and explained in a concise yet clear way, with exmaples and exercises.

This book should find its place on the bookshelf of everyone interested in geometrical concepts required for understanding contemporary theoretical physics.

I recommend this book to all students and professionals. It should find its place in every university library. Just one warning: certain mathematical symbols did not find their way to the "Index of frequently used symbols" at the end of the book. The reader trying to read the book starting from p. 600 may find it necessary to spent some time going through the earlier chapters to find out the meaning of a given symbol.

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Kay zum Felde (Frankfurt am Main, Germany), www.amazon.de

★★★★★ **Precise and concise book on Differential Geometry and Lie Groups**, 6. März 2008

This is book is great for every theoretical physicist. Although I've yet not red the whole book, everything I yet studied is explained in a concise and precise manner. Fecko's book incorporates many short exercises that point direct to the issue and thus encourage the reader to think about the lines just been red. The exercises are very often supported by hints to avoid bottlenecks in the readers thoughts. Marian Fecko has found a very good way at least to form my imagination. Although the book is about differential geometry and Lie groups it also includes chapters about Clifford algebras, spinors etc. Fecko mixes up the precise description of mathematicians and the imagination of physicists; it turns out a book that is really recommendable.

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Đorđe Radičević (Princeton, USA) www.amazon.com

★★☆☆☆ **Fairly good content, very bad exposition**, July 15, 2008

There's no doubt about it: the material in this book is incredibly interesting and important for an ambitious physics student. The organization of the book is fairly good: informal passages relating the necessary theory alternate with exercises which are all written as "Check that..." or "Prove that...", which allows you to choose which results to prove and which to take as given facts if you -- for any reason -- don't feel like proving them.

However, the book also has some serious shortcomings. The most important one seems to be the horrid style. A book of mathematics for physicists should not be written just like a standard math textbook without proofs -- and this is exactly what this book is like. The definitions that are given are "mathematical" at heart; very rarely can one find an intuitive picture of what is going on immediately after a concept is introduced. On the other hand, the propositions that are not left as excercises are never proven. Granted, they might be intuitively clear, but that doesn't mean that their proofs are obvious. Due to all this, I have always felt a bit confused and certainly not comfortable with new concepts. The author's occasional attempts to "raise morale" by inserting jokes would always backfire because these jokes are so trivial that they seem offensively condecending. Take, for example, the sentence that finishes the introduction of a vector as the equivalence class of tangency of curves:

"And a good old arrow, which cannot be thought of apart from the vector, could be put at P in the direction of this bunch, too (so that it does not feel sick at heart that it had been forgotten because of some dubious novelties)." (p. 25)

So... first of all, this is probably not particularly funny. But more seriously: are we to conclude that the notion of vectors as "directed lines" is important only because otherwise the "good old arrow" (and the reader alike) would feel "sick at heart"? This is an example of a concept so intuitive that a joke like this is generally harmless; however, trouble arises when the same kind of explanation is applied to more abstract concepts (e.g. why not study non-Hausdorff spaces? The explanation given on p. 4 relates to Amazon Basin Indians).

Another important issue is that a large part of this book teaches you the principles of the mathematics behind the physics. This is fine, provided you learn how to operate with these principles; however, the book seldom teaches you how to *work* with the most basic concepts, and that's what the author promises to deliver in the preface.

Unfortunately, there are other issues as well. Introducing new, vital ideas in exercises *only* is one of them.

Also, one would desire to know which ideas are crucial or well-worth meditating upon, and this is generally not given in the text. Finally, the excessively informal style prevents this book from being even a good reference.

All in all -- it is possible to learn a lot of new things from this book, but the effort probably isn't worth it.

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Andrew Tan, www.amazon.com

★★★★☆ **Excellent reference for self study**, September 2, 2008

An excellent reference for self-study. Four stars not five, because contrary to its claim, a reader with an undergraduate physics background cannot read it from the start to end without referring to other books. I decided to learn some General Relativity after hearing Smolin talk better smack than Triple H, and encountering Penrose's intriguing Road to Reality. Fecko logically and succintly weaves together many possible views of each subject he discusses. He clarified for me, for example, the links between the approaches taken by the texts of d'Inverno and Ludvigsen. Many of these links are given as well-structured exercises, so the book is best used when one has an uneasy suspicion that something might be true. Fecko also gives outstanding motivations and intuitive pictures for many definitions. Even after I had understood pull-backs and differentials, it was a delight to discover that putting a shoe on my foot was as good as putting my foot in the shoe.

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★★★★★ **Alles über Differentialgeometrie und Lie Gruppen**, 28. September 2011

Von

Alexander1 www.amazon.de

Rezension bezieht sich auf: Differential Geometry and Lie Groups for Physicists (Taschenbuch)

Dieses Buch enthält ALLES was ein fortgeschrittener Physik Student so braucht zu dem Thema. Es ist extrem umfangreich und ich habe noch nichts vermisst und in einem anderen Buch nachschauen müssen. Das Stichwortverzeichnis ist extrem gut und man findet dadurch und durch die vielen Querverweise die Definitionen sehr schnell. Es enthält nur sehr wenige (ausgeführte) Beweise, aber macht durch viele sinnvolle Beispiele und viele kleine Aufgaben die Beweise im Wesentlichen vor. Diese kleinen Aufgaben helfen die Definitionen oder Sätze zu verstehen.

Es liest sich sehr gut, gerade da besonders das Wesentliche betont und geübt wird. Trotzdem werden alle Defintionen so allgemein wie möglich gehalten und erst in Beispielen werden einfachere Situationen behandelt.

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★★★★★ Forces independent discovery of concepts through hundreds of small exercises

ByAmara Katabarwa on September 4, 2015

Format: Paperback

You can't be a spectator while reading the book. I am a physics graduate student and I must confess I was at first very annoyed that every single concept was built using exercises, I am used to sitting down reading a book for 10 minutes or 20 minutes intervals and then doing an exercise or two, but this book is very different. There are few paragraphs and literally no full pages where the author explains concepts, lays out proofs and does examples. The reader builds up every concept through little exercises. I eventually calmed down and realized happily that the exercises were making me think of the little and subtle concepts I would have missed had everything been laid out for me. The wonderful thing is that the exercises are very short , the author puts helpful hints or even the full solution. For example in " Geometry of physics" or " Geometry, Topology and Physics" there are explanations of what flow of vector fields are, there is usually a picture and a paragraph of two explaining and deriving the concepts. That is not the case with this book, everything about the flows the reader finds out by doing little exercises. This takes getting used but is so worth it.

The material of this book is very wide and about as much as Theodore frankel's book but it

goes slower and is definitely better than Nakahara's book.
WARNING FOR PHYSICISTS: Be prepared to think abstractly, this might be hard if you haven't seen advanced undergraduate maths courses

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★★★★★ Perfect for self study
By Amazon Customer on July 27, 2017 www.amazon.com
Format: Kindle Edition
This book is a gem for physicists trying to self study and repeatedly getting lost in books written by mathematicians! Although, the early chapters might need to be supplemented with some more rigorous texts (mostly, to find rigorous answers and proofs to the questions in the middle of the text (with hints to most of them)), the exposition is highly intuitive and logical. Also examples and exercises related to physics really help in developing a good conceptual grasp! The only problem is that you can't read it on a bed, or half asleep :P

★★★★★ Great book on differential geometry
By Mikael Sahrling on August 19, 2017 www.amazon.com
Format: Paperback|Verified Purchase
Best introductory book on the subject I have read. It's more from a physicists view point and really helps getting a feel for the subject.

★★★★★ Masterpiece in Exposition, Depth, and Breadth.

Manuel Reviewed in the United States on October 5, 2022
The best differential geometry book to bridge the gap between physics and mathematics texts.

Exposition: Instead of concentrating on proving things it allows you experience building up the theory and the explanations are superbly done. Also the hints to the problems make them doable with sufficient effort no matter how difficult they may be. I am now convinced that there is no better book for the self study of differential geometry. Also, having build up the theory I managed to retain so much information topics I had attempted to study in the past.

Breadth: For physics it contains almost everything you could ever ask for and even things you didn't know you wanted.

Depth: Although one can argue that you can go more indepth. I have never witnessed a book written for physicists that is both comprehensible enough to make it a joy to work through yet detailed enough to give you the ability to read books and papers written in mathematical physics and even other areas of mathematics. Moreover, unlike many mathematics texts teaches you both the notation of physicists to do computations and the notation of mathematicians to do proofs.

Anyway buy this underated gem of a book. You won't regret it. I even bought two extra copies of the book for my two friends who are physics PhD students like me.

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odlan
★★★★★ livro de geometria diferencial para físicos. Recebi hoje.
Reviewed in Brazil on February 10, 2024
Verified Purchase
Livro de capa comum. Boa impressão e paginação de boa qualidade. Recebi hoje 09/02/2024.

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http://arkadiusz.jadczyk.salon24.pl/27026,index.html

Coś dla fizyków teoretyków - Differential Geometry and Lie Groups for Physicists

Listonosz przyniósł mi dziś zamówioną przed paru dniami książkę:

Marian Fecko, "Differential Geometry and Lie Groups for Physicists", Cambridge University Press, 2006, 697 stron.

Po przeglądnięciu spisu treści i lekturze tych wyjątków, które mi właśnie były potrzebne do pracy, chcę gorąco polecić tą monografię wszystkim zainteresowanym. Powinna się w nią szybko zaopatrzyć każda biblioteka matematyczna i fizyczna.

Ze spisem treści i wyjątkami można zapoznać się w witrynie Autora.

P.S. Autora nie znam osobiście, więc nie mam w tej reklamie żadnych interesów osobistych.

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YF17A
Post subject: Re: how much is one expected to know to go into theory?
Posted: Mon Mar 02, 2009 10:15 pm
http://www.physicsgre.com/viewtopic.php?f=3&t=2169

If you're interested in string theory, you eventually need to be familiar with this kind of math (I'm taking this list from a response from a family friend who is now a string theory prof at a top-5 university, in response to a very similar question I asked him a few years ago):

Complex analysis (at the level of Chapter Zero of Griffiths and Harris)
Differential geometry (Boothby is a good intro text; I also like "Differential Geometry and Lie Groups for Physicists" by Fecko)
Algebra (Cox, Little and O'Shea)
Group theory/Lie theory/representation theory (Georgi is more physics-oriented, while Fulton and Harris is more math-oriented)
Algebraic topology (Bott and Tu is the bible)
Algebraic geometry (Cox Little and O'Shea is a good introduction)
Pretty much everything on this list is touched on in Nakahara, "Geometry, Topology, and Physics"; it's not a great book to learn from, but it's an excellent compendium of all the math you'll eventually need to know

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czelaya
01-27-2009, 03:10 PM
Schrodinger's handywork:
http://forums.clubrsx.com/showthread.php?p=25117315

If your ever interested in learning differential geometry for self study I suggest the two following books:

1.)Differential Geometry and Lie Groups for Physicists: Marián Fecko

2.)Geometry of physics: Theodore Frankel

Like I said, before people always laugh when I tell them the most difficult math is algebra(group theory, commutators, ect....). Differential Geometry at times, is much more difficult. Its notation appears so much easier than calculus, but once you realize the meaning of the interpertion, the equation becomes daunting. Manifold space is preplexing.

I didn't realize you were so well versed in mathematics(applied). I could never learn advanced mathematics by mathematicians. Obviously, an accomplished feat that you have undertaken bc generally, mathematician think in too much of an abstract manner. This is why I feel physicist and physical scientist do so well with mastering advanced math. They always have something tangible to grasp in their minds.

Fourier transforms are the most potent arsenal for physical scientist. When you cant find a solution to a partial differential equation FT's to the rescue.

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martin_blckrs
Nov3-09, 02:39 PM
Re: who wants to be a mathematician?
http://www.physicsforums.com/showthread.php?p=2425041
…
For DG, I think there's no cannonical text, but there are some good books. A good introductory text is John M. Lee "Introduction to Smooth Manifolds". It's not really my taste (mainly because of lengthy and not so elegant proofs), but it covers a lot of topics and explains everything in detail (which becomes sometimes also its disadventage). Another good text is Warner's "Foundations of Differentiable Manifolds and Lie Groups" (less topics, more advanced). For more intuitive treatment and exercises there's a book by Fecko "Differential Geometry and Lie Groups for Physicists" ("for Physicists" says everything :-D).

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Where does a mathematically trained person go to learn mathematical physics? ...
http://mathoverflow.net/questions/4183/mathematical-physics-particularly-computational
...

For your classical hydrodynamics indeed the classical textbooks and reference books suffice, but for people interested in a bit more modern mathematical physics we could add (in various level of exposition and specialization)

- Yvonne Choquet-Bruhat, Cecile Dewitt-Morette, *Analysis, manifolds and physics*, 1982 and 2001
- Albert Schwartz, *Quantum field theory and topology*, Grundlehren der Math. Wissen. 307, Springer 1993. (translated from Russian original)
- Bernard F. Schutz, *Geometrical methods of mathematical physics* (elementary intro)
- ...
- Leon A. Takhtajan, *Quantum mechanics for mathematicians*, Graduate Studies in Mathematics 95, Amer. Math. Soc. 2008.
- Marian Fecko, *Differential geometry and Lie groups for physicists*
- V. S. Varadarajan, *Supersymmetry for mathematicians: an introduction*, AMS and Courant Institute, 2004.
- ...

Zoran Škoda May 18 2010 at 16:36

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http://www.mathhelpforum.com/math-help/analysis-topology-differential-geometry/149127-help-differential-forms.html

help with differential forms?

enderwiggin

I'm teaching myself from Spivak's Calculus on Manifolds, and am having trouble understanding differential forms the way he's explaining them. Are they multilinear functions still? Or are they something completely different? Or are they a formalization of vector fields?

June 25th, 2010 10:07 AM #8

chloeagnew

Hi Enderwiggin!
I suggest you read Marian Fecko's 'Differential Geometry and Lie Groups for Physicists'. This is a great book!!! You will clearly know almost everything in Differential Geometry if you read it and do the exercises in the book!!!

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Xiaoyi

Hello! I joined today.I am an undergraduate student.major in Physics.This is the last year of my four-year undergraduate eduation.I am very interested in Gravitational Theory.I also like to read Geometry and QFT.I am a green hand of theories.I hope we can talk about some problems.
I like to read Marian Fecko's Differential Geometry and Lie Groups for Physicists, Vladimir Arnold's Mathematical Methods for Classical Mechanics, Ryder's QFT.
Do you think these books are very nice?

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http://www.vysous.cz/cv_vzdelani.php (= Jan Vysoký)

A proč baví diferenciální geometrie mě? Narozdíl od spousty podivných algebraických předmětů má obrovskou aplikaci v každé fyzikální teorii, některé na ní dokonce stojí (obecná teorie relativity). Na druhou stranu je intuitivní, matematicky naprosto korektní (je to ostatně matematická teorie), obsahující příměsi z mnoha různých částí matematiky.

Na tomto místě nemůžu nezmínit dvě vynikající knížky.

První a pro mě zásadní je *Diferenciálna geometria a Lieove grupy pre fyzikov* od Mariána Fecka. Tato knížka je neuvěřitelně obsáhlá, obsahuje úplné základy i poměrně pokročilé partie. Není mi úplně jasné, jak může autor znát tolik věcí najednou. Většina z knihy je vykládána formou tvrzení a důkazy ponechanými čtenáři (společně s návodem). Tento přístup je velmi pedagogický, naučil mě vlastní hlavou pracovat s matematickým aparátem diferenciální geometrie. Samozřejmě je to ale někdy trošičku na obtíž, knížka se zkrátka nedá používat jako referenční příručka. Nicméně každý, kdo to s diferenciální geometrií myslí vážně, má skvělou možnost, navíc v (skoro) rodném jazyce, který se vždy čte o něco příjemněji.

Druhou důležitou knihou je *The Geometry of Physics* od Theodora Frankela. Narozdíl od Feckovy knihy se výrazně méně zabývá detailním rozborem matematických vlastností. Matematiku podává někdy lehčím a intuitivnějším způsobem, například zavedení vnějšího součinu a derivace považuji za výrazně zdařilejší. Teoretické kapitoly jsou často doplněny příklady fyzikální aplikace, což je nejen zajímavé, ale i užitečné. Je dobré číst tuhle knihu paralelně s předchozí. Často totiž umožní člověku nahlédnout na problém dvěma odlišnými pohledy a poznat jejich vzájemnou bezrozpornost, což vede k mnohem hlubšímu pochopení. Bohužel se tahle knížka dá sehnat jen za nepěkné peníze (Cambridge Press).

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Aug15-10, 08:51 AM
George Jones

Re: How to find suitable exercises to practice on (in physics geometry) ?
http://www.physicsforums.com/showthread.php?t=422373

Have a look at Differential Geometry and Lie Groups for Physicists by Marian Fecko,

http://www.amazon.com/Differential-G...1879791&sr=8-1,

and at the review

http://www.cap.ca/BRMS/Reviews/Rev857_554.pdf

of this book.
This is still a tough go, and will not be everybody's cup of tea.

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Differential geometry for a physicist?

Oct7-10, 10:40 AM

http://www.physicsforums.com/showthread.php?t=426925
George Jones
As n!kofeyn has stated, contents of differential geometry references vary widely. Another book worth looking at is Differential Geometry and Lie Groups for Physicists by Marian Fecko,

http://www.amazon.com/Differential-G...1879791&sr=8-1.

This book is not as rigorous as the books by Lee and Tu, but it more rigorous and comprehensive than the book by Schutz. Fecko treats linear connections and associated curvature, and connections and curvature for bundles. Consequently, Fecko can be used for a more in-depth treatment of the math underlying both GR and gauge firld theories than traditionally is presented in physics courses.

Fecko has an unusual format. From its Preface,

> *A specific feature of this book is its strong emphasis on developing the general theory through a large number of simple exercises (more than a thousand of them), in which the reader analyzes "in a hands-on fashion" various details of a "theory" as well as plenty of concrete examples (the proof of the pudding is in the eating).*

The book is reviewed at the Canadian Association of Physicists website,

http://www.cap.ca/BRMS/Reviews/Rev857_554.pdf.

From the review

> *There are no problems at the end of each chapter, but that's because by the time you reached the end of the chapter, you feel like you've done your homework already, proving or solving every little numbered exercise, of which there can be between one and half a dozen per page. Fortunately, each chapter ends with a summary and a list of relevant equations, with references back to the text. ...*
>
> *A somewhat idiosyncratic flavour of this text is reflected in the numbering: there are no numbered equations, it's the exercises that are numbered, and referred to later.*

Personal observations based on my limited experience with my copy of the book:

1) often very clear, but sometimes a bit unclear;
2) some examples of mathematical imprecision/looseness, but these examples are not more densely distributed than in, say, Nakahara;
3) the simple examples are often effective

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1.

I am in love with Fecko's Differential Geometry and Lie Groups for Physicists. Despite not being just about mechanics (but rather about more or less all rudimentary modern theoretical

physics) it discusses both Lagrangian and Hamiltonian formalism. It also provides countless exercises (with nice hints) so that you can really get a feel for the matter.

http://physics.stackexchange.com/questions/1601/classical-mechanics-without-coordinates-book

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http://gdus.us.es/proyectos20102011/650059_1858_8645.pdf

PROYECTO DOCENTE

ASIGNATURA:
"Grupos de Lie"

Grupo: Grupo de TEORIA de GRUPO DE LIE.(875710)

Titulacion: LICENCIADO EN MATEMÁTICAS (Plan 98)

Curso: 2010 - 2011

Autores:	Y. Chow	***Edición:***	Gordon and Breach Ed. (1987)
Publicación:	Vol. 1, 2	***ISBN:***	
Differential Geometry and Lie Groups for Physicits			
Autores:	M. Fecko	***Edición:***	Cambridge University Press (2006)
Publicación:		***ISBN:***	
Lie Algebras			
Autores:	N. Jacobson	***Edición:***	Dover (1979)
Publicación:		***ISBN:***	
Lie Groups and Lie Algebras			

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BOOKSILIKE

Goldstein. Klassische Mechanik
Landau, Lifshitz. The Classical Theory of Fields

Weinberg. The Quantum Theory of Fields
Zeidler. Quantum Field Theory I
Fecko. Differential Geometry and Lie Groups for Physicists
Reed. I Functional Analysis
Lieb, Loss. Analysis
Lee. Introduction to Topological Manifolds
DeWitt-Morette, Cartier. Functional integration

http://gottwald.me/work/booksilike/index.html

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http://translate.google.sk/translate?hl=en&sl=zh-CN&u=http://cmft.hfcas.ac.cn/%3Fp%3D10&prev=search

Department of Modern Physics, University of Science and Technology of China graduate courses (bilingual) :

"Introduction to the theory of moving magnetized plasma cyclotron"

Introduction to the gyrokinetic theory for magnetized plasmas

Speaker: Qin Wang in governance

3 Feb. 8 - May 21 2011

Tuesday afternoon (4: 45-6: 20), the ninth and tenth class

Friday afternoon (2: 50-4: 25) class 7,8

References:

Differential geometry and geometric dynamics:

- Liangcan Bin, Zhou Bin, differential geometry and general relativity tutorial (on) online video
- Fecko, Marián, Differential Geometry and Lie Groups for Physicists, Cambridge University Press / World Publishing (2006) ISBN # 0-521-84507-6
- Benard Schutz, Geometrical Methods of Mathematical Physics, Cambridge Univ. Press (1980) / World Publishing
- JE Marsden & TS Ratiu, Introduction to Mechanics and Symmetry, 2nd Ed., Springer (1999) / World Publishing
- DD Holm, T. Schmah, & C. Stoica, Geometric Mechanics & Symmetry, Oxford Univ. Press (2009)

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http://infohost.nmt.edu/~iavramid/math442/m442syl09s.html

MATH 442: Introduction to Differential Geometry

Spring 2009

Instructor: Ivan Avramidi

Supplementary material: There are many other books that can be used for further study. I recommend the following:

- B. Schutz, *Geometrical Methods of Mathematical Physics* , Cambridge Univrsity Press, 1999
- W. M. Boothby, *Introduction to Differentiable Manifolds and Riemannian Geometry*, Academic Press, 2003
- B.A. Dubrovin, A.T. Fomenko and S.P. Novikov, *Modern Geometry - Methods and Applications*, Parts 1 and 2, 2nd Edition, Springer, 1992
- S. P. Novikov and I. A. Taimanov, *Modern Geoimetric Structures and Fields*, AMS, 2006
- M. Spivak, *A Comprehensive Introduction to Differential Geometry*, Publish or Perish, 1979
- C. Isham, *Modern Differential Geometry for Physicists*, 2nd Edition, World Scientific, 1999
- M. Fecko, *Differential Geometry and Lie Groups for Physicists*, Cambridge University Press, 2006
- J. A. Thorpe, *Elementary Topics in Differential Geometry*, Springer-Verlag, 1994
- H. Flanders, *Differential Forms with Applications to the Physical Sciences*, Academic Press, 1967
- R.L. Bishop and S.I. Goldberg, *Tensor Analysis on Manifolds*, Macmillan, 1968
- C.T.J. Dodson and T. Poston, *Tensor Geometry*, Pitnam, 1977
- V. G. Ivancevic and T. T. Ivancevic, *Applied Differential Geometry*, World Scientific, 2007

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http://scipp.ucsc.edu/~haber/ph251/ph251_11.pdf

Physics 251 Group Theory and Modern Physics Spring 2011

Instructor:	Howard Haber
Office:	ISB, Room 326
Phone Number:	459-4228
E-mail:	haber@scipp.ucsc.edu
Office Hours:	Mondays, 2–4 pm
Course Website:	`http://scipp.ucsc.edu/~haber/ph251/`

TEXTBOOK:

Group Theory for Physicists, by Zhong-Qi Ma

Strongly recommended:

Problems and Solutions in Group Theory for Physicists, by Zhong-Qi Ma and Xiao-Yan Gu
Group Theory in Physics, by Wu-Ki Tung
Lie Groups, Lie Algebras, and Some of Their Applications, by Robert Gilmore

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Selected references in topology and differential geometry for physicists:

An Introduction to Spinors and Geometry, by A.M. Benn and R.W. Tucker
Analysis, Manifolds and Physics, by Y. Choquet-Bruhat, C. DeWitt-Morette and M. Dillard-Bleick
Differential Geometry and Lie Groups for Physicists, by Marián Fecko
The Geometry of Physics: An Introduction, by Theodore Frankel
Differential Geometry for Physicists, by Bo-Yu Hou and Bo-Yuan Hou
Manifold Theory: An Introduction for Mathematical Physicists, by Daniel Martin
Lectures on Advanced Mathematical Methods for Physicists, by Sunil Mukhi and N. Mukunda
Geometry, Topology and Physics, by M. Nakahara
Topology and Geometry for Physicists, by Charles Nash and Siddhartha Sen
Geometrical Methods of Mathematical Physics, by Bernard Schutz

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http://ects.slu.cz/fakulty/MU/MU/03053?lang=en

Silesian University in Opava

Course: Geometric Methods in Physics II

Lecturer(s)

SERGYEYEV Artur, Doc. RNDr. Ph.D.

Recommended literature:

- C. Isham. *Modern Differential Geometry for Physicists*. Singapore, 1999.

- D. Krupka. *Matematické základy OTR*.
- K. Erdmann, M. Wildon. *Introduction to Lie algebras*. Springer, 2006.
- L.H. Ryder. *Quantum Field Theory*. 1996.
- M. Fecko. *Diferenciálna geometria a Lieove grupy pre fyzikov*. Bratislava, Iris, 2004.
- M. Nakahara. *Geometry, Topology and Physics*. Institute of Physics Publishing, 1990.
- O. Kowalski. *Úvod do Riemannovy geometrie*. Univerzita Karlova, Praha, 1995.
- S. Caroll. *Lecture Notes on General Relativity*.

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http://study.upol.cz/fakulty/PRF/KAG/DGN?lang=en

PALACKÝ UNIVERSITY IN OLOMOUC

Course: Differential Geometry

Lecturer(s)

- Mikeš Josef, prof. RNDr. DrSc.

Recommended literature

- Boček L. (1976). <I>Tenzorový počet</I>. SNTL Praha.
- Budinský B. (1983). <I>Analytická a diferenciální geometrie</I>. SNTL Praha.
- Budinský B. Kepr B. (1970). <I>Základy diferenciální geometrie s technickými aplikacemi</I>. SNTL Praha.
- DO Carmo M. (1994). <I>Differential Forms and Applications</I>. Springer.
- DO Carmo M. (1976). <I>Differential Geometry of Curves and Surfaces</I>. Prentice-Hall.
- Doupovec, M. (1999). <I> Diferenciální geometrie a tenzorový počet</I>. VUT Brno.
- Fecko M. (2004). <I>Diferenciálna geometria a Lieove grupy pre fyzikov</I>. Iris, Bratislava.
- Gray A. (1994). <I> Differential geometry</I>. CRC Press Inc.
- Hicks N. J. (1965). <I>Differential geometry</I>. Van Nostrand Comp.
- Isham C. J. (1989). <I>Modern Differential Geometry for physicists</I>. World Scientific.
- Klingenberg W. (1978). <I> A course of differential geometry</I>. Springer.
- Vanžurová, A. (1996). <I>Diferenciální geometrie křivek a ploch</I>. UP Olomouc.

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http://math.stackexchange.com/questions/46482/introductory-texts-on-manifolds

I enjoyed Fecko's Differential Geometry and Lie Groups for Physicists. It doesn't contain complete bottom-up theory building and omits hard proofs but it is a very neat general introduction to the basics of manifolds; it explains very well *why* the stuff should work the way it does and also provides very nice (usually physical) applications. In addition, it contains a big amount of interesting exercises.

In the latter chapters it also briefly scratches interesting topics from algebraic topology and group theory. I think an informal and high-level book like this is useful addition to the rigorous texts. Especially for beginners.

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http://student.physik.uni-mainz.de/~rothalex/

Hi,
das ist meine Homepage. Schau dir mal meine Physik-Programme und die Programmempfehlungen an.
Gruß Alexander
PS: Buchempfehlung: Differential Geometry and Lie Groups for Physicists - Fecko ; ISBN: 0521845076
PPS: *Flow* to my homepage *some time later* with the Hamiltonian vector field ;-)

.....

Mar 1, 2013 #23 atyy

https://www.physicsforums.com/threads/book-on-differential-geometry.669849/page-2

I liked Crampin and Pirani , as well as Fecko. Both are very physicky. Fecko is a little long winded, but I find all his asides charming and insightful. Lee is very, very good. Even though it's apparently a serious maths book, it's written so that even non-mathematicians can enjoy it at our own lower level (like a novel).

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Aug 21, 2014 #33 atyy

https://www.physicsforums.com/threads/what-math-books-should-i-read-to-understand-general-relativity.766757/page-2

I liked Crampin and Pirani http://www.amazon.com/Applicable-Differential-Geometry-Mathematical-Society/dp/0521231906 and Fecko http://www.amazon.com/Differential-Geometry-Lie-Groups-Physicists/dp/0521187966 (very weird, but very fun and good explanations). My background is a biologist reading for fun, so I think these are pretty approachable like Nakahara, which I like also. A great free set of notes on GR is Blau's http://www.blau.itp.unibe.ch/GRLecturenotes.html. And another free set on more advanced topics is Winitzki's https://sites.google.com/site/winitzki/index/topics-in-general-relativity.

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http://www.abclinuxu.cz/blog/vituv_blog/2009/7/priprava-na-matematiku-na-mff/diskuse

Tak ma teraz napadlo, máš niečo spoločné s Mariánom Feckom, ktorý učí na bratislavskom matfyze teoretickú fyziku (hlavne diferenciálnu geometriu)? Mám tu od neho totiž výbornú knižku "Diferenciálna geometria a Lieove grupy pre fyzikov", čo bola zatiaľ asi najlepšia investícia do vzdelania

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http://www.physicsforums.com/showthread.php?t=561898

Re: Chiral Lagrangian symmetry

I learned most of my group theory from Dresselhaus and Tinkham's Group Theory books, Georgi's Lie Algebras in Particle Physics (available online for free, though not as related to this issue in particular) and Fecko's Differential Geometry and Lie Groups for Physicists. I especially like the last book.

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http://www.goodreads.com/review/show/375113301

MeComplexta's review
Jul 23, 12

★★★★★
bookshelves: to-read, physics-math

Awesome book, explainig a lot about differential geometry. The author is one of the best teachers at Faculty of Mathematics and Physics at Comenius University in Bratislava.

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http://physics.stackexchange.com/questions/21306/what-math-do-i-need-for-mathematical-physics-in-what-manner-should-i-learn-math

> For the Lie group and differential geometry part, I strongly recommend Fecko: "Differential Geometry and Lie Groups for Physicists". – altertoby Feb 23 '12 at 14:53

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http://www.sciforums.com/showthread.php?134021-Why-two-mass-attracts-each-other/page9

05-02-13, 03:11 AM #167
Markus Hanke

... My primary reference for all of the above is "*Differential Forms and Connections*" by R.W.R. Darling, where this is all made mathematically precise and rigorous.
A scondary source then is Fecko's "*Differential Geometry and Lie Groups for Physicists*", which is an excellent book and a standard text for any undergrad physics student. ...

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http://topologyandgeometry.blogspot.sk/2013/03/dpdpdpdsdsdpdssdpds-displacement-vector.html
回复王沐涛：for multi-linear algebra, you can check 代数学引论第二卷 Kostrikin(柯斯特利金) and <Differential Geometry and Lie Groups for Physicists> by Marian Fecko.
2012-08-14 12:24
喜欢 回复

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http://math.stackexchange.com/questions/620833/most-important-aspects-of-differential-geometry-for-general-relativity

It is not clear to me whether you are an aspiring physicist or mathematician but - besides the fine references given by Michael Albanese et al.- I would suggest another one which might be more in line with the immediate needs and style of a physicist.

Differential geometry and Lie groups for physicists by Marian Fecko

This book will give you what you need to get a headstart in GR (general relativity) and some QFT (quantum field theory) using an easy, conversational style.

Pleasee note that Wald employs Penrose's abstract index notation, which is similar, yet different than the usual index notation used by most/all mathematics books

answered Dec 29 '13 at 23:11

magma

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http://physics.troplet.com/question/topology-needed-for-differential-geometry-30295.html

Topology needed for Differential Geometry

I am a physics undergrad, and need to study differential geometry ASAP to supplement my studies on solitons and instantons. How much topology do I need to know. I know some basic concepts reading from the Internet on topological spaces, connectedness, compactness, metric, quotient Hausdorff spaces. Do I need to go deeper? Also, could you suggest me some chapters from topology textbooks to brush up this knowledge. Could you please also suggest a good differential geometry books that covers diff. geom. needed in physics in sufficient detail, but not too mathematical? I heard some names such as Nakahara, Fecko, Spivak. How are these?

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http://www.physics.wsu.edu/People/Faculty Pages/People-Faculty-Gittes.html

Calendar and syllabus - Physics 590, Section 2 seminar (Spring 2014)1

Seminar: **Differential geometry in physics**. A guided self-study of selected tools from differential geometry. As physicists, our focus will be on understanding rather than proof or precision. Enroll specifically for **Section 2** of Physics 590. Time: Thursdays 4:10-5:00. We plan to meet in the Band room, Webster 1243 (not the official room). **Send your email and be alert for room changes.** Instructor: Fred Gittes (gittes@wsu.edu, 1254 Webster). Grading: 1 credit, S/NS, passing requires attendance of ten or more classes. **Possible background:** Graduate classical mechanics (PHYS 521), or general relativity

(PHYS 581), or other advanced classwork.
Self-study: I will provide some ungraded exercises. All are encouraged to turn the discussion to areas of their own physical interest.
Excerpts of texts, along with my own prepared notes, will be handed out at various points in the class.
Some of the books that may be referenced or excerpted, in alphabetical order (* = on reserve at Owen):
Abraham R and Marsden JE, *Foundations of Mechanics*, 1978. (Publically available as PDF)
Burke WL, *Applied Differential Geometry*, Cambridge 1985.
Fecko M, *Differential Geometry and Lie Groups for Physicists**, Cambridge 2006. (QC20.7.D52 F43 2006)
Frankel T, *The Geometry of Physics**, Cambridge 1997-2011. (QC20 .F7 1997)
Misner, Thorne & Wheeler (MTW), *Gravitation**, Freeman 1973. (QC178 .M57)
Schutz B, *Geometrical Methods of Mathematical Physics**, Cambridge 1980. (QC20.7.D52 S34)

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1 Fred Gittes, Washington State University. Initial draft: Jan 13, 2014. This compilation 1/14/14 (12:05pm) from "590-14S-cal.tex."

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http://www.karlin.mff.cuni.cz/~enaipi/GC/

Gentlemen's Club of Non-equilibrium Thermodynamics

Everyone is welcome! Seminar room of Mathematical Institute MFF UK (Karlin, Prague)

Some nice books and papers

- Grmela, Öttinger, Dynamics and thermodynamics of complex fluids. I. Development of a general formalism, Phys. Rev. E (1997), vol. 56(6)
- Öttinger, Grmela, Dynamics and thermodynamics of complex fluids. II. Illustrations of a general formalism Phys. Rev. E (1997), vol. 56(6)
- Jou, Casas-Vázquez, Lebon: Understanding Non-equilibrium Thermodynamics
- Öttinger, H. C., Constraints in nonequilibrium thermodynamics: General framework and application to multicomponent diffusion, J. Chem. Phys (2009), 130(11)
- Salmon, R., Hamiltonian fluid mechanics, Ann. Rev. Fluid Mech. (1988), 20
- Fecko, M., Differential Geometry and Lie Groups for Physicists, CUP 2006
- Lebon, Jou, Casas-Vázquez: Extended Non-Equilibrium Thermodynamics
- Öttinger: Beyond Equilibrium Thermodynamics
- Callen: Thermodynamics and an Introduction to Thermostatistics
- Atkins, de Paula: Atkins' Physical Chemistry

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http://dxdy.ru/topic95217-45.html

Re: План изучения геометрии и теории групп для теор.физа

По дифгему, думаю, понравится Fecko "Differential Geometry and Lie Groups for Physicists". Во-первых, то, что там есть, физику, с вашими запросами, совершенно необходимо. Т.е. проблема выборочности чтения становится куда менее острой. А во-вторых, приятно, что приложения к физике: механика, ОТО, Янг-Миллс, расписано явно. Так что проблема вида: читаешь Кобаяси, Номидзу

и думаешь: "как на этом языке будет выглядеть действие Янга-Миллса?" (и плюс "во-первых": "так ли этот кусок необходим?"), читаешь Рубакова и думаешь: "как это сказать математически красиво?", также исчезает.

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Библиотека естественных и технических наук
Рекомендуемые книги по изучению физики в форматах pdf и djvu. Все взяты из ранее выложенных списков лучших книг. Некоторые из них на английском языке, если найдёте перевод и скинете в комментарии, буду очень благодарен.

Математический аппарат:
Белоусов, Кузнецов, Смилга Практическая математика. Руководство для начинающих изучать теоретическую физику
Элементы прикладной математики Зельдович Мышкис
Hans Ringstrom The Cauchy Problem in General Relativity
Markus Heusler Black hole uniqueness theorems
S. Sternberg Group Theory and Physics
Mathematics for Physics: A guided tour for graduate students Michael Stone
and Paul Goldbart
Byron fw Fuller rw Mathematics of classical and quantum physics
Tensor analysis on manifolds Bishop Goldberg
Fecko M. Differential geometry and Lie groups for physicists
Introductory Functional Analysis with Application Kreyzig
Georgi H. Lie algebras in particle physics
Griffiths P., Harris J. Principles of algebraic geometry
Quantum Mechanics in Simple Matrix Form Jordan
.....

http://dxdy.ru/topic92350.html

illuminates 10.01.2015, 18:16 Добрый день. Хотел бы вашей рекомендации о том какие книги написаны, с одной стороны на современном математическом языке, с другой имеют хорошие направления, главы, указания на физику непосредственно.

Вообще, мне бы хотелось в первую очередь, что-бы там определялся тензор как тензорное перемножение пространств и сопряженных пространств. Я к сожалению, об этом не имею и понятия. Почему нужны эти два пространства? Почему не одно? и т.д. Что-бы в книге максимально все подробно рассказывалось (быть может на физических примерах)

вообще на примете такие книги
1) Современная геометрия - Дубровин, Новиков, Фаменко
К сожалению в ней, не водится этих сопряженных пространств. Или я просто не дошёл?
2) Кострикин Манин - Линейная алгебра и геометрия
Там как раз определение, что я хочу понять. Но оно в самой последней главе. Не знаю, смогу ли я понять осилить все главы. Не так уж и легко читаются они. Я как раз и в сомненьях и пишу сюда чтоб спросить. Может есть альтернативы?
3) Пенроуз Риндлер Спиноры и пространство-время

Вроде видел что там то же похожее что-то написано. Но стоит ли начинать именно с неё?

vanger 10.01.2015, 19:36 Fecko, Differential Geometry and Lie Groups for Physicists. Идеально удовлетворяет требованиям. Как можно понимать 6 параграф из ЛЛ2, предварительно не зная всего, о чём там написано, для меня остаётся загадкой.

.....

https://nauka-online.ru/rebyat-a-mozhet-est-tut-fiziki-teoretiki-interesno-uznat-kak-nachat-delat-shagi-6886

organometallic3353 November 15, 2015 12:14

Ребят, а может есть тут физики-теоретики, интересно узнать как начать делать шаги именно к специализации теоретика, ну и просто узнать " А есть ли вообще смысл?".

organometallic3353

...

Теперь о прочих книгах: для изучения математического аппарата классической теории поля Fecko differential geometry and Lie groups просто шикарен и незаменим, по квантовой механике прекрасен Киселев (лекции по квантовой механике), по калибровочным полям, составляющим основу теории элементарных частиц, читал Рубакова, по гравитации у меня смесь знаний из ландафшица, переведенные уже мысленно на нормальный язык из Fecko + отдельные факты, надерганые из разных книг типа Мизнера, Торна, Уиллера Гравитация, со всяких лекций и т.д.

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http://www.techques.com/question/5-9704/Why-is-the-Yang%E2%80%93Mills-existence-and-mass-gap-problem-so-fundamental

Why is the Yang–Mills existence and mass gap problem so fundamental?

Dear Anonymous, gauge theories such as QCD are among the easiest theories to be formulated yet richest theories when it comes to the phenomena they cover, many of which are important in the real world.

The existence of the mass gap - the absence of arbitrarily small positive values in the mass spectrum - is a simple property of QCD that holds but that hasn't been rigorously demonstrated.

To demonstrate it and win the $1 million from the Clay Institute, she has to define the quantum field theory at a rigorous mathematical level and master much of its physics in an equally rigorous way. So it's a good, simple enough to be formulated, mathematical problem whose solution would bring mathematicians' mastery to a higher level.

At the same moment, the paper that would win the $1 million award would almost certainly not be very important for physicists. Physicists have found lots of complementary ways and insights that made them sure that the mass gap exists. Harboring doubts about the mass gap or trying to "totally" eliminate these doubts is simply not what theoretical physicists in this discipline spend most of their man-hours.

...

Luboš Motl H
2011-05--11 08:36:11

I'd add (parahrasing Fecko) that while everyone agrees that mathematical physics and rigorous argumentation is important for physics, the opinion of how much it is important in each concrete case varies between 0 and 100 percent :)
Marek H

2011-05-11 08:48:09
And so does the definition of rigor in theoretical physics. ;-)
Luboš Motl H
2011-05-11 09:11:45

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http://www.reddit.com/r/IWantToLearn/comments/2kcpju/iwtl_knot_theory_as_quickly_as_possible/

the_krug IWTL knot theory as quickly as possible.

I've taken a research job in an adjacent field, and I'd like to learn the basics (notation, common examples) so that I don't look like a complete fool every time they explain what is going on.

This will be along with a slower, more methodical read through Collin Adams' *The Knot Book* , but I'd like to not have to wait till chapter N to be taught the basic notation, which I may need in my job sooner rather than later.

I'd like to also understand, once I know the notation and whatnot, how this could be applied to various branches of physics such as particle physics and cosmology, as some sources suggest.

mian2zi3 What's your background? Adams' book isn't targeted at mathematicians. You can probably read it in a weekend. If you have a math background, you probably want to start with Lickorish's An Introduction to Knot Theory. It is still relatively elementary but requires some algebraic topology. For connections with physics, that's a big project. How's your differential geometry? You might start with Baez, Muniain, Gauge Theory, Knots and Gravity. I also really like Fecko's Differential Geometry and Lie Groups for Physicists (really a math book). Then you can think about working towards Witten's work on Chern-Simons theory and the Jones polynomial, although maybe you are thinking of other connections.

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http://www.if.nu.ac.th/sites/default/files/bin/syllabus-geom.pdf

Course Syllabus: 8970602: Geometrical Methods in Physics
Start date: Wednesday 13th August 2014
Lecturer
Pichet Vanichchapongjaroen
The Institute for Fundamental Study
Naresuan University
65000 Thailand

Recommended Books
[1] B. Schutz, Geometrical Methods of Mathematical Physics. Cambridge University Press, 1980.
[2] F. de Felice and C. Clarke, Relativity on Curved Manifolds. Cambridge Monographs on Mathematical Physics. Cambridge University Press, 1992.
[3] R. Wald, General Relativity. Physics, astrophysics. University of Chicago Press, 1984.
[4] M. Fecko, Differential Geometry and Lie Groups for Physicists. Cambridge University Press, 2006.
.....

Peterku, diskusia v sme.sk

Dobre, napisal 700 stranovu knihu a nech sa mu to pripise k dobru, ze si prezul a ujasnil klasicke veci stare 70 rokov (ucebnica Kolara, Michora a Slovaka s podobnym obsahom ako Feckova obsahuje ovela modernejsie partie diferencialnej geometrie a aj lepsie sa predava: ono je totiz rozdiel, ked knihu napise vedec a nie iba ucitel). Inak zasvatenci vedia, ze nakladatelstvo Cambridge University press vydava dva druhy knih: prestiznu seriu monografii, do ktorej Feckova biblia nepatri a potom vselico ine, len nech je to hrube.
S hlavickou Cambridge sa v dalekej Arabii, na Slovensku aj v Uzbekistane preda skutocne vsetko a editori nakladatelstva o tom dobre vedia...

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Mehmed, diskusia v sme

Čo napríklad Marián Fecko? Koľko má odborných publikácií v porovnaní s Prešnajderom alebo Semerákom? Nemám poruke štatistiky, ale tiež by som tipoval, že to bude rádovo nižšie číslo. A pritom napísal excelentnú knihu o geometrii, ktorá svojim konceptom nemá v zahraničných publikáciách obdobu. A na geometriu je Fecko naslovovzatý odborník. Len má menej publikácií. Ale jeho prednášky sú vysoko vážené aj v Čechách.
Chcem tu poukázať na to, že ak sa zameriate len na jedno kritérium, možete dostať výsledok aký chcete.
.....

Peterku, diskusia v sme.sk

Inak Feckova ucebnica obsahuje sedemdesiatrocne neskutocne rozvlacne podane zakladne veci, a kedze sa asi nepohybujete vonku, asi na vas posobi, ze mu to vyslo v Cambridge University Press. (Ako vidite, nedrzim tu stranu Slovakom, snazim sa byt objektivny).

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https://is.cuni.cz/studium/eng/predmety/index.php?do=predmet&kod=NTMF061

Group Theory and its Applications in Physics - NTMF061

Charles University in Prague, Institute of Theoretical Physics, Faculty of Mathematics and Physics

Course, academic year 2016/2017

Guarantor: RNDr. Karel Houfek, Ph.D., RNDr. Přemysl Kolorenč, Ph.D.

Literature:

Morton Hamermesh: Group Theory and Its Application to Physical Problems, Dover Publications, 1989

Shlomo Sternberg: Group theory and physics, Cambridge University Press, Cambridge 1994

Otto Litzman, Milan Sekanina: Užití grup ve fyzice, Academia, Praha 1982

Marián Fecko: Diferenciálna geometria a Lieove grupy pre fyzikov, IRIS, Bratislava 2004, chapt. 10-12

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https://is.cuni.cz/studium/eng/predmety/index.php?do=predmet&kod=NTMF060

Geometrical Methods of Theoretical Physics II - NTMF060

Charles University in Prague, Institute of Theoretical Physics, Faculty of Mathematics and Physics

Course, academic year 2014/2015

Guarantor: prof. RNDr. Jiří Bičák, DrSc., dr. h. c.,

doc. RNDr. Pavel Krtouš, Ph.D.

Literature:

M. Fecko: *Diferenciálna geometria a Lieove grupy pre fyzikov*, IRIS, Bratislava 2004.

O. Kowalski: *Základy Riemannovy geometrie*, skripta, Karolinum, Praha 1995.

P. Krtouš: *Geometrické metody ve fyzice*, http://utf.mff.cuni.cz/vyuka/%TMF060/GeometrickeMetody/, 2008.

S. Kobayashi a K. Nomizu: *Foundations of Differential Geomatry I*, Interscience Publishers, New York 1963.

M. Spivak: *A Comprehensive Introduction to Differential Geometry*, Publish or Perish Press, New York 1970-1979.

T. Frankel: *The Geometry of Physics - An Introduction*, Cambridge Univ. Press, Cambridge 1999.

M. Nakahara: *Geometry, Topology and Physics*, Taylor & Francis, London 2003.

J. A. de Azcárraga, J. M. Izquierdo: *Lie Groups, Lie Algebras, Cohomology and some Applications in Physics*, Cambridge Univ. Press, Cambridge 1995.

Ch. J. Isham: *Moddern Differential Geometry For Physicists*, World Scientific, Singapore 1989.

C. von Westenholz: *Differential Forms in Mathematical Physics*, North-Holland, Amsterdam 1978.

R. Penrose, W. Rindler: *Spinors and space-time, Volume 1*, Cambridge Univ. Press, Cambridge 1984.

P. O'Donnell: *Introduction to 2-Spinors in General Relativity*, World Scientific, Singapore 2003.

C. W. Misner, K. S. Thorne a J. A. Wheeler: *Gravitation*, Freedman, San Francisco 1973.

S. W. Hawking a G. F. R. Ellis: *The Large Scale Structure of Space-Time*, Cambridge Univ. Press, Cambridge 1973.

R. Wald: *General Relativity*, Univ. of Chicago Press, Chicago 1984.

R. A. Bertlmann: *Anomalies in Quantum Field Theory*, Oxford Univ. Press, Oxford 1996.

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https://www.reddit.com/r/elimath/comments/2suiqy/explain_the_difference_between_geometric_algebra/

Explain the difference between "geometric algebra" and the differential geometric (differential forms) framework, like I am a math PhD student (self.elimath) submitted 4 months ago by itsme_santosh

[–]mian2zi3 4 months ago

...

I strongly recommend Lee's book on smooth manifolds and Fecko's awesome book on differential geometry and Lie theory for physicists -- don't let the title fool you, it's really a math book.

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http://physics.iut.ac.ir/en/Graduated_Programs

GRADUATE PROGRAM IN FACULTY OF PHYSICS

Isfahan University Of Technology, Department of Physics

20-10-724 Advanced Mathematical Physics

Textbooks:

1. Mikio Nakahara, Geometry, Topology and Physics, (IOP 2003)

2. C. Nash, S. Sen, Topology and Geometry for Physicists, (Academic Press 1987)

3. M. Fecko, Defferential Geometry and Lie Groups for Physicists, (Cambridge University Press 2006)

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http://km.fjfi.cvut.cz/lide/burdik-cestmir

Předmět:	**Základy teorie reprezentací a Lieových algeber**	**01TRLA**	prof.RNDr. Burdík Čestmír DrSc.	-	2+0 ZK	- 2

Anotace: Lieovy algebry jsou neodmyslitelnou součástí teorií v mnoha oblastech přírodních věd. V přednášce jsou formulovány elementární základy teorie Lievých algeber a jejich reprezentací.

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Literatura: Povinná literatura:
[1] Hall, Brian C.: Lie Groups, Lie Algebras, and Representations: An Elementary Introduction, Springer, ISBN 0-387-40122-9, 2003.

Doporučená literatura:
[2] Marian Fecko: Diferencialná geometria a lieovy grupy pre fyzikov, IRIS, Bratislava, 2004.

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Upabjojr commented 28 days ago (2015)

I once wrote a gist on how to get the gradient operator in different frames of reference

https://gist.github.com/Upabjojr/34f75ce115f1cf5a6afc

I followed the instructions on *Differential Geometry and Lie Groups for Physicists* by *Marián Fecko*. It contains short formulae on how to derive the gradient, divergence and curl for arbitrary coordinate systems, given their connections to the orthogonal one.

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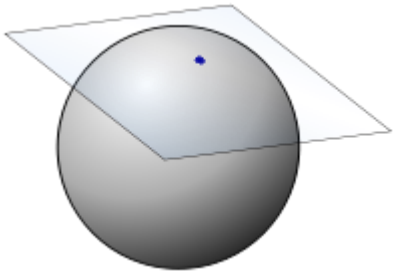
https://cs.wikipedia.org/wiki/Te%C4%8Dn%C3%BD_prostor

Tečný prostor

Matematický pojem **tečný prostor** variety v daném bodě značí množinu všech jejích tečných vektorů "vázaných" v tomto bodě, viz *Obr. 1*. Na každém tečném postoru je přirozeným způsobem dána struktura vektorového prostoru; odtud tedy označení tečný *prostor*.



Obr. 1: Intuitivní geometrická představa tečného prostoru koule

Obsah

Literatura

Fecko M., Differential Geometry and Lie Groups for Physicists, Cambridge 2006

Krump L., Souček V., Těšínský J. A.: Matematická analýza na Varietách, skripta MFF UK, Karolinum 1999

Kovalski O., Úvod do Riemannovy geometrie, Univerzita Karlova, Praha 1995

.....

Physical and Mathematical musings
http://ciqkl3vlveoaup6vlu5r7wp3hp55ixirwhygq5j626i6ynjpgk3poei.ipfs.neocitiesops.net/index.html

Recommended Books

1. Differential Geometry and Lie Groups for physicists -Marian Fecko
2. Elementary Introduction to Lie Groups and Representations-Brian. C Hall
3. Quantum Field Theory for the Gifted Amateur-S.Blundell, Tom Lancaster
4. A short Course on General Relativity- James Foster, Nightingale David
5. Quantum Field Theory in a nut-shell- Anthony Zee
6. An Introduction to Abstract Algebra- Derek J.S Robinson
7. Category Theory for the sciences- David Spivak
8. An Introduction to Category Theory-Harold Simmons
9. Lie groups for physicists - Robert Hermann

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http://mathoverflow.net/questions/61235/background-to-learn-about-manifolds

Arkadiusz Jadczyk very much recommended **M.Fecko**'s textbook ("Differential geometry and Lie groups for physicists").

answered May 21 2016 at 14:24

Mihail Denisov
211

.....

http://michael-kraus.org/index.html

Homepage of Michael Kraus

Research References: Geometry

Differential Geometry and Topology (Physics Oriented)

- Gerardo F. Torres del Castillo: Differentiable Manifolds - A Theoretical Physics Approach (2012)
  Birkhäuser, ISBN: 978-0-8176-8270-5
- Mikio Nakahara: Geometry, Topology and Physics (2003)
  Taylor & Francis, ISBN: 978-0750306065
- Theodore Frankel: The Geometry of Physics (2011)
  Cambridge University Press, ISBN: 978-1107602601
- Stephen Lovett: Differential Geometry of Manifolds with Applications to Physics (2010)
  Taylor & Francis, ISBN: 978-1568814575
- Marcelo Epstein: The Geometrical Language of Continuum Mechanics (2010)
  Cambridge University Press, ISBN: 978-0521198554
- Marián Fecko: Differential Geometry and Lie Groups for Physicists (2006)
  Cambridge University Press, ISBN: 978-0521845076
- Michael Stone and Paul Goldbart: Mathematics for Physics - A Guided Tour for Graduate Students (2009)
  Cambridge University Press, ISBN: 978-0521854030
- Bernard F. Schutz: Geometrical Methods of Mathematical Physics (1980)
  Cambridge University Press, ISBN: 978-0521298872
- Chris J. Isham: Modern Differential Geometry for Physicists (1999)
  World Scientific Publishing, ISBN: 978-9810235628
- Helmut Eschrig: Topology and Geometry for Physics (2011)
  Springer Lecture Notes in Physics, Vol. 822, ISBN: 978-3-642-14699-2

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https://www.physicsforums.com/threads/book-on-differential-geometry-topology-with-applications.867815/

Hello! I want to learn about the mathematics of General Relativity, about Topology and Differential Geometry in general.
...

Somebody told me to look for Nakahara's book but i found that it does not explain anything really properly. Also, i was told to check out Frankel's "Geometry in physics" and at a first glimpse i found it really good but i did not have the time to properly study from it.

...

Apr 22, 2016 #10 atyy
I like Fecko's book. It's covers the material similar to Nakahara and Frankel, but the presentation is funnier, so you may like it.

Apr 22, 2016 #11 Adam Landos
Does it also share the same care for geometrical intuition?

Apr 22, 2016 #12 mathwonk
here on the author's website you can read for yourself two sample chapters. i glanced at the

one on tangent spaces to manifolds and rather liked it.
http://sophia.dtp.fmph.uniba.sk/~fecko/book.html

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https://www.physicsforums.com/threads/sources-about-killing-vector-fields.873555/

May 28, 2016 #1 fresh_42
I'm interested in Killing vector fields and want to ask whether anybody can name me a good textbook or online-source about them, preferably with a general treatment with local coordinates as examples and not at the center of consideration.

May 28, 2016 #2 George Jones
Starting on page 83, "Differential Geometry and Lie Groups for Physicists", by Fecko, has my favourite treatment of Killing vectors. It has lots of great examples in its short exrecises. I am not sure if has enough coordinate-invariant stuff for your tastes, but it does start with the definition $L_\xi g=0$, where L is the Lie derivative and the vector field ξ is generated by a one-parameter group of isometries.

May 29, 2016 #3 fresh_42
Thank you.
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https://2ch.hk/math/res/3784.html
Аноним 05/12/16 Пнд 07:48:13 №4701
>>4301
Топчик по дифгему для физиков: Fecko "Differential Geometry and Lie Groups for Physicists" Гораздо лучше ДНФ, НТ. Постников торт, но связности в 4 томе так себе изложены.

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https://www.tutel.me/c/mathematics/questions/1891814/maurercartan+form+and+leftinvariant+vector+fields
Dac0 2016-08-14 12:47:37
Maurer Cartan form Is not really explained everywhere. I can suggest you Spivak (2nd book), Fecko (Differential Geoemtry of Lie Groups) and if you have time and patience I would suggest you to read some chapters here and there of "Boothby, An Introduction to Differentiable Manifolds and Riemannian Geometry".

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http://mathoverflow.net/questions/252114/reference-for-homogeneous-spaces

2 down vote favorite **1**

I am a graduate student of differential geometry. I would like to get an overview over the way, how results are usually obtained for homogeneous spaces by Lie algebraic methods. By definition a Riemannian homogeneous space is a quotient G/H of a Lie group G modulo a closed subgroup H together with an $\mathrm{Ad}(H)$-invariant scalar product on a complement to the tangent space of H. As far as I know many results that are

difficult to obtain for general manifolds are much easier to get for homogeneous spaces, since one can reduce the problem to a Lie algebraic problem. I would like to get an overview about the way how this method is used. How does one reduce the problem to a Lie algebraic one? Do you know any references in the internet about this method? Thank You in advance.

An Introduction to Lie Groups and the Geometry of Homogeneous Spaces written by By *Andreas Arvanitogeōrgos* is a useful reference Read online here.

Another good reference for physic and math students is *Differential Geometry and Lie Groups for Physicists* written by *Marián Fecko* Read on google book.
answered Oct 13 '16 at 23:12 C.F.G 322115

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http://physics.stackexchange.com/questions/29956/book-covering-differential-geometry-and-topology-required-for-physics-and-applic

Book covering differential geometry and topology required for physics and applications

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Fecko - Differential Geometry and Lie Groups for Physicists

Develops the basic theory of manifolds (the focus is not on topology), and eventually treats a bunch of topics including classical mechanics (symplectic geometry), gauge theory and spinors. There is also a (much shorter) set of lecture notes by Fecko on the same topic.

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http://ckw.phys.ncku.edu.tw/public/pub/Notes/PathIntegral/Swanson/4._FurtherApplications/MomentumOperatorInGeneralCoordinates.pdf

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Theory

Ref: Any textbook on differential geometry, e.g., M.Fecko, “Differential Geometry & Lie Groups for Physicists”, Cambridge Univ. Press (2006).
In an 1-particle Hilbert space, the inner product between states

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https://physics.stackexchange.com/questions/283051/what-is-the-purpose-of-emphasizing-that-an-action-is-invariant-under-diffeomorph/283068

After checking the book 'Differential Geometry and Lie Groups for Physicists' by Marian Fecko in section 16.4.1, I believe that I am close to understanding what physicists mean by invariance of an action under diffeomorphism. In what follows, I explain Marian Fecko's discussion on diffeomorphism invariance of an action.

Consider a classical field theory ϕ on a Riemannian manifold (M,g), where g_{ab} is its metric. We say the action natural with respect to diffeomorphism in the following sense. Let us define such a

differential form $\Omega[\phi,g]$ defined via the action

$$S[\phi,g]=\int_D\Omega[\phi,g]=\int_D L(\phi,\nabla\phi,g)\omega_g$$

where $D\subset M$ is a submanifold and ω_g is the volume form on D associated with the metric g.

etc. etc. etc.

answered Sep 29 '16 at 10:42, Xiaoyi Jing

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https://physicstravelguide.com/advanced_tools/topology#tab__student
The Physics Travel Guide

Topology

- Why is it interesting?
- Layman
- Student
- Researcher
- Examples
- FAQ
- History

Topology is the branch of mathematics that deals with continuous deformation and with properties that remain invariant under continuous deformation.

- Selected topological concepts used in physics - An introductory exposition by Marián Fecko
- How to Talk to a Physicist: Groups,Symmetry, and Topology by Daniel T. Larson
- http://www.math3ma.com/mathema/2015/9/14/open-sets-are-everything
- https://jeremykun.com/2013/01/12/the-fundamental-group-a-primer/
- https://jeremykun.com/2013/04/03/homology-theory-a-primer/
- https://jeremykun.com/2012/11/04/topological-spaces-a-primer/

https://physicstravelguide.com/advanced_tools/differential_geometry#tab__student

Differential Geometry

- Why is it interesting?
- Layman
- Student
- Researcher
- Examples
- FAQ
- History

- Differential Geometry in Physics An introductory exposition for true non-experts by Marián Fecko
- Differential Geometry and Lie Groups for Physicists by Marián Fecko

- Manifolds and Differential Forms lecture notes by Reyer Sjamaar

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https://www.quora.com/Do-you-need-to-know-a-lot-of-differential-geometry-to-read-Walds-general-relativity

2019

Martin Scholtz, Gravitational Physicist, Postdoc Researcher at Charles University in Prague (2014-present)

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But I suggest to study

1. Carroll's book together with some differential geometry book . My personal favorite is Fecko: Differential geometry and Lie groups for physicists. The latter is very good because it is quite explanatory, it explains the "philosophy" of differential geometry , but it leaves all proofs and exercises to the reader. This is painful from the beginning, but it gives you really good understanding of what's going on. Another useful book on differential geometry are classical book by Kobayashi and Numizu, they are more precise and more mathematically correct, but they lack the explanatory part (it's just a definition-theorem-proof style).

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https://physics.stackexchange.com/questions/309889/why-exactly-in-general-relativity-are-tangent-vectors-defined-as-maps-from-funct

asked Feb 5 '17 at 14:05
Programmer2134
Why is the velocity, and hence the tangent space, defined as a map from a function to the real numbers? Why isn't it defined more naturally as the derivative of γ with respect to the parameter of γ?

Xiaoyi Jing
answered Feb 5 '17 at 15:22
In rigorous mathematical oriented books of differential geometry, people do not explain much about the intuition behind the definition. If you want to know more about the physical motivations, you should read the book "Differential Geometry and Lie Groups for Physicists" by Marian Fecko. This book is a good one for getting started learning geometry.

Programmer2134 Feb 6 '17 at 17:37
I followed your advice and started reading the book by Marian Fecko. I've reached the point concerning this question. Indeed the book says that those two definitions are "equivalent".

However, I am not quite sure what he means by that. It seems to me that they are not exactly the same. The tangent vector defined as an equivalent class of tangent curves at P, is not literally the same mathematical object as the directional derivative of a function $f(M)$ at point P. They are "equivalent" in some sense that I find unintuitive, but they're not exactly the same, right?

Xiaoyi Jing Feb 7 '17 at 1:38
As far as I could remember, the proof that the two definitions are equivalent is left as an exercise in Fecko's book. What you need to do is to start from definition A and show that it implies B, and start from B to show that it implies A. If you have great difficulties in this mathematical proof, just send an email to Marian Fecko. He always answers questions regarding his book.

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http://www.fciencias.unam.mx/docencia/horarios/presentacion/290668

Matemáticas (plan 1983) 2018-2

Optativas de los Niveles V y VI, Geometría Diferencial II

Grupo 4233, 15 lugares. 5 alumnos.

Profesor	Augusto Cabrera Becerril	lu mi vi 13 a 14 O126
Ayudante	Víctor Manuel Espíndola Moreno	ma ju 13 a 14 O126

- Presentación

Titular: M. en C. Augusto Cabrera Becerril

Ayudante: Víctor Manuel Espíndola Moreno

El curso estará dividido en tres partes. En la primera haremos una introducción a la teoría de variedades diferenciables. Estudiaremos el espacio tangente, el haz tangente, funciones diferenciables en variedades y campos vectoriales.

En una segunda parte estudiaremos el concepto de curvatura. Daremos una introducción a tensores y formas diferenciables, construiremos los tensores de curvatura para una variedad y haremos una revisión de los espacios con curvatura constante.

En una tercera parte daremos una breve introducción al estudio de grupos y álgebras de Lie. Nos detendremos brevemente en la aplicación de la teoría de Lie en la solución de ecuaciones diferenciales (Análisis de simetrías).

Bibliografía básica

- Michael Spivak A comprehensive course on Diferential Geometry Vol 1-2. Publish or Perish
- Lawrence Conlon, Differentiable Manifolds, Birkhäuser
- Wolfgang Kühnel, Differential Geometry, AMS
- Vladimir G. Ivancevic , Tijana T. Ivancevic . Applied Differential Geometry: A Modern Introduction . World Scientific

- Francis Borceux. A differential Approach to Geometry. Springer.
- S.S. Chern, W.H Chen y K.S. Lam, Lectures on Differential Geometry. World Scientific
- Mikio Nakahara, Geometry, topology and Physics, Graduate Student Series in Physics
- Oscar Palmas y J. Guadalupe Reyes Curso básico de Geometría Diferencial T2. Las Prensas de Ciencias
- B. A. Dubrovin, A. T. Fomenko, S. P. Novikov Modern Geometry- Methods and Applications. Springer.
- William Boothby, An introduction to Differentiable Manifolds and Reimannian Geometry, Academic Press
- Frank Warner, Foundations of differentiable Manifolds and Lie Groups, Scott Foresman and Co
- Marián Fecko, Differential Geometry and Lie Groups for Physicists, Cambridge University Press

Se realizarán 3 o 4 examenes parciales, cada uno con una lista de ejercicios correspondiente que servirá en principio como guía para el examen.

Página del curso : https://sites.google.com/ciencias.unam.mx/gdii

Universidad Nacional Autónoma de México (UNAM), Facultad de Sciencias

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https://www.physicsforums.com/threads/a-good-book-on-tensors.914341/

May 11, 2017 #1 Wrichik Basu
I need a good book on tensors, so that I can understand and get good hold of the topic. Can anyone recommend me a good book, like one used in undergraduate level?

atyy May 11, 2017
Two books I really like are Crampin and Pirani's Applicable Differential Geometry and Fecko's Differential Geometry and Lie Groups for Physicists. They give the translation between the mathematical notation using differential geometric objects and physicist's index gymnastics.

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https://www.reddit.com/r/math/comments/b1btac/preparing_for_a_phd_in_differential_geometry/

Posted by
u/penberbromster
23 days ago (March 2019)

Preparing for a PhD in differential geometry

Hi guys, so there's a good chance I'm going to end up doing a PhD in differential geometry. I already have an advisor in mind who's offered to supervise me and is pretty keen on it. I have a bit over a year to prepare; what kind of reading should I do?

...

I know some geometry from physics. I can recommend some books. These shouldn't really require any physics knowledge to understand.

Baez and Munian - Gauge Fields, Knots, and Gravity (Despite its name, this is my favorite intro to differential geometry)

Schutz - Geometrical Methods of Mathematical Physics (Very naive but easy intro)

Bertlmann - Anomalies in Quantum Field Theory (First 120 pages)

Fecko - Differential Geometry and Lie Groups for Physicists

Guillemin and Pollack - Differential Topology

Milnor - Topology from the Differentiable Viewpoint

Hermann - Lie Groups for Physicists

Isham - Modern Differential Geometry for Physicists

Madsen and Tornehave - From Calculus to Cohomology

Nair - Quantum Field Theory (Chapter 14)

Nakahara - Geometry, Topology, and Physics

Naber - Topology, Geometry, and Gauge Fields Foundations

Naber - Topology, Geometry, and Gauge Fields Interactions

Nash and Sen - Topology and Geometry for Physicists

Schlichenmaier - Introduction to Riemann Surfaces, Algebraic Curves, and Moduli Spaces

Warner - Foundations of Differentiable Manifolds and Lie Groups

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penberbromster
2 points · 23 days ago

The book by Fecko is really nice reading, thanks for all the recs! I find that physicists really do treat differential geometry much better than mathematicians in general. Wonder why that is so..

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Luis J. Garay, Lecture notes: Lie Groups and Fibre Bundles
Madrid, 15 April 2015

Universidad Complutense de Madrid
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Luis J. Garay luisj.garay@ucm.es
Tel.: + 34 913944552, Fax: + 34 913944557

Bibliography
Basic
[CDD91] Y. Choquet-Bruhat, C. DeWitt-Morette, M. Dillard-Bleick,
Analysis, manifolds and physics (North Holland, 1991)
[CuM85] W.D. Curtis, F.R. Miller, Differential Manifolds and Theoretical Physics
(Academic Press, 1985)
[Fec06] M. Fecko, Differential Geometry and Lie Groups for Physicists
(Cambridge University Press, 2006)
[Ish99] C.J. Isham, Modern differential geometry for physicists , 2nd ed.
(World Scientific, 1999)
[Lee02] J.M. Lee, Manifolds and Differential Geometry
(American Mathematical Society , 2009)

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https://ar-ar.facebook.com/groups/171352399724187/

Alex Louis Mustang
٦ ربـوتـكأ ٢٠١٧

Can someone help me find resources to study differential geometry on my own? I want to study it because of applications i theoretical physics. mainly i have started following Prof Frederic Schuller's lectures (geometric anatomy of theoretical physics).They are great, but i often find myself stuck in various topics. Also, i started looking at Nakahara.. but found it slightly abve my level too. So cam someone suggest some beinner level resources? ? THANKS in advance.

#alexlrm

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Pascal Vollmer
Clarification: both texts, Fecko and Tu are fine grained and proceed in little steps. Tu is math only, Fecko is math (75%) and physics (25%).

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https://www.etit.tu-darmstadt.de/media/etit/01_etit/formulare_studium/ordnungen/modulhandbuecher/msc_modulhandbuecher/MSc_ETiT_-_CED_2014_-_EN.pdf

M.Sc. Electrical Engineeringand Information Technology(PO 2014)
Computer-Aided Electrodynamics
Date: 01.03.2019

p.21:
References:
M. Fecko: Differential Geometry and Lie Groups for Physicists, Cambridge University Press, 2006F.
Hehl, Y. Obukhov: Foundations of Classical Electrodynamics, Birkhäuser, 2003K. Jänich: Vector Analysis, Springer, 2001

Course Nr. 18-dg-2030-vl
Course name Electromagnetics and Differential Forms
Instructor Prof. Dr.-Ing. Stefan Kurz

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https://dxdy.ru/topic41692-30.html

01/09/12
Посоветуйте полноценный задачник по дифференциальной геометрии для студентов-математиков, а то ничего подходящего найти не могу. Заранее благодарю!

04/12/10
Только Fecko, "Differential Geometry and Lie Groups for Physicists", только хардкор. Если английский не смущает, конечно. Это идеальный учебник по дифгему, нужному в физике. Дифференциальногеометрическая часть Волобуева, Кубышина -- это копипаст из Кобаяси, Номидзу с выкинутыми доказательствами.

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https://vk.com/wall-74479926_80737?reply=80825

Ваш ТОП 10 учебников из любой научной области.

Vladislav Balakirev

1. Зорич, математический анализ
2. Кострикин, Манин, линейная алгебра и геометрия
3. Fecko, differential geometry and Lie groups for physicists
4. Виро, Нецветаев и др., элементарная топология
5. Хелемский, лекции по функциональному анализу
6. Lee, intruduction to smooth manifolds
7. Hall, Lie groups, Lie algebras and representations
8. Джет Неструев, гладкие многообразия и наблюдаемые
9. Богачев, Смолянов, действительный и функциональный анализ
10. Арнольд, математические методы классической механики

20 Aug 2016

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https://github.com/Tanedo

https://github.com/Tanedo/Physics262-2019

Group Theory for Physicists, Physics262-2019

Lec 18: What physicists should know about fiber bundles, how it shows up in electromagnetism. There are many good references for fiber bundles. I suggest 1607.03089 and any review articles on electrodynamics from a geometric picture. For more systematic treatments grounded in physics, *Mathematical Methods in Classical Mechanics* by Arnold is fantastic. Other introductions inclue Vol. II of Polchinski's string theory books or the text by Nakahara. *Mathematics for Physicists* by Stone and Goldbart is also a good introduction at this level. I've also heard good things about *Differential Geometry and Lie Groups for Physicists* by Fecko.

Prof. Flip Tanedo, UC Riverside, Particle Theory

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https://www.homotopico.com/2019/06/10/hodge-star.html

References

- Báez, J. C. and Muniain, J. P. (1994). *Gauge Fields, Knots, and Gravity*, World Scientific. Section I.5. Honestly I don't even know why you'd read this post, go and read Báez instead.
- Quintero Vélez, A. (2018). *Notas de Fundamentos Matemáticos de las Teorías de Campos Gauge*.
- Fecko, M. (2006). *Differential Geometry and Lie Groups for Physicists*. Cambridge University Press. This is a great book with great humor. Chapter 5 is a good introduction to differential forms. It is a problem-driven book.
- Conrad, B. *Notes for Math 396: Tensor Algebras, Tensor Pairings, and Duality.*http://virtualmath1.stanford.edu/~conrad/diffgeomPage/handouts/tensor.pdf

.....

https://www.thphys.uni-heidelberg.de/~floerchinger/teaching/

Priv.-Doz. Dr. Stefan Floerchinger

Theoretical physicist at Heidelberg University.

TEACHING

Summer term 2020, Lecture: Symmetries

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Literature

- M. Fecko, *Differential Geometry and Lie Groups for Physicists*
- P. Ramond, *Group Theory, A Physicist's Survey*
- A. Zee, *Group Theory in a Nutshell for Physicsists*
- J. Fuchs and C. Schweigert, *Symmetries Lie Algebras and Representations*
- H. Georgi, *Lie Algebras in Particle Physics*
- H. F. Jones, *Groups, Representations and Physics*

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http://ymsc.tsinghua.edu.cn/en/content/show/190-233.html

Geometry of Gauge Theories

Speaker：Philsang Yoo
Time： Every Thursday 8:30 -11:00 am, 2020 - 8 - 6 ~ 9 - 24
Venue：Zoom online

Description

ZOOM ID：649 514 7070（no password）

Speaker Introduction

Abstract： In this mini course, we discuss geometric aspects of gauge theory, including the theory of connections and spinors. Depending on participants' interest and time constraints, we may touch on supersymmetric aspects of the subject.

Prerequisite： differentiable manifolds, Lie groups and Lie algebras
Reference： Baez, Muniain - Gauge fields, knots and gravity
Fecko - Differential geometry and Lie groups for physicists
Frankel - The geometry of physics
Gilmore - Lie groups, physics, and geometry
Gockeler, Schucker - Differential geometry, gauge theories, and gravity
Naber - Topology, geometry, and gauge fields
Nakahara - Geometry, topology, and physics
Nash, Sen - Topology and geometry for physicists
Hamilton - Mathematical gauge theory
Jost - Geometry and physics
Rudolph, Schmidt - Differential geometry and mathematical physics
Sternberg - Curvature in Mathematics and Physics

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http://www.if.nu.ac.th/sites/default/files/bin/course_syllabus_geomtric_if_2019_0.pdf

Course Syllabus 897602: Geometrical Methods in Physics

Lecturer
Sikarin Yoo-Kong

The Institute for Fundamental Study “Tah Poe Academia Institute”
Naresuan University
65000
Thailand

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Grading
Homework 30%
Technical report 30%
Midterm examination 20%
Final examination 20%

Suggested books to read!

1. B. Schutz, Geometrical methods of mathematical physics, 1st edition, 1980, Cambridge University Press.
2. M. Fecko, Differential geometry and Lie groups for physicists, 1st edition, 2006, Cambridge University Press.
3. T. Frankel, The geometry of physics: An introduction, 3rd edition, 2011, Cambridge University Press.
4. M. Nakahara, Geometry, Topology and Physics, 2nd edition, 2003, Institute of Physics Publishing. (recommended!)
5. L. W. Tu, An introduction to manifolds, 2nd edition, 2010, Springer.
6. R. Gilmore, Lie groups, physics, and geometry, 2008, Cambridge.

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https://www.physicsforums.com/threads/modern-differential-geometry-textbook-recommendation.991298/

Thread starter kay bei Start date Jul 11, 2020

Could you provide recommendations for a good modern introductory textbook on differential geometry, geared towards physicists. I know physicists and mathematicians do mathematics differently and I would like to see how it is done by a physicists standard. I have heard Chris Ishams “Modern Diff Geometry for Physicists” is good in this respect but I don’t know how modern or at what level this is at. Theodore Frankels Geometry of Physics is mentioned a lot and highly regarded as being the most complete and comprehensive. I would like to get your opinions on what textbooks you think will be leading the way forward in physics classes on Diff Geom for Physicists?

Answers and Replies Jul 11, 2020 #2 George Jones

This is highly subjective, i.e., it is highly dependent on the course and instructor. For example, even though everything can be treated in the context of bundles, I think that (semi)Riemannian geometry should be separated out from the material on bundles. I think this for two reasons: 1) this is pedagogically better; 2) this is the way differential geometry underlying general relativity (semi-Riemannian) and gauge field theories (bundles) traditionally is treated. Of the books I mention below, Fecko, Nakahara, and Frankel all do

this, while Isham doesn't. I quite like Isham's book, but it might be a bit terse for self-study. Frankel proceeds at (I think) at a slightly more leisurely pace. "Geometry, Topology, and Physics" by Nakahara is possibly the most standard text. Folks here know that I am a big fan of "Differential Geometry and Lie Groups for Physicists" by Marian Fecko.

Fecko has an unusual format. From its Preface, A specific feature of this book is its strong emphasis on developing the general theory through a large number of simple exercises (more than a thousand of them), in which the reader analyzes "in a hands-on fashion" various details of a "theory" as well as plenty of concrete examples (the proof of the pudding is in the eating). I have found that this format works well for me, but other folks might have different opinions, though I know that some others here at PF also like Fecko. Fecko is reviewed at the Canadian Association of Physicists website, http://www.cap.ca/BRMS/Reviews/Rev857_554.pdf

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https://physics.stackexchange.com/questions/609098/marrying-statistical-mechanics-and-differential-geometry
asked Jan 21, 2021 at 0:23

Recently, I have been trying to get a more thorough understanding of the mathematics at the fundaments of theoretical physics. I liked V.I. Arnol'd's introduction to mechanics and the book by Ratiu and Marsden, but what really blew me away were Marian Fecko's book and Ferederic P. Schuller's lectures on the "Geometric Anatomy of Theoretical Physics"

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https://www.quora.com/Do-you-know-of-a-book-that-combines-differential-geometry-and-Lie-groups-with-for-example-chapters-on-Lie-groups-Varieties-Fiberspaces-and-Gauge-Fields

Do you know of a book that combines differential geometry and Lie groups (with, for example, chapters on Lie groups, Varieties, Fiberspaces, and Gauge Fields)?

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Hey there!

Before giving you my recommendations, a clarification: a Lie group is by definition also a differentiable manifold. That being said, I realize there are presentations of Lie groups that make no mention of manifolds, so the question is still valid. My recommendations are the following:

For something oriented more towards mathematicians, I'd suggest

- **Loring Tu's "Differential Geometry".** While not as rigorous as some mathematicians might want it to be, Tu's writing style makes it incredibly accessible and fun to read.

Now, as a theoretical physicist myself, I obviously have more books to recommend that are mostly aimed toward physicists:

1. **Nakahara's "Geometry, Topology and Physics"**. Sometimes I find the presentation a bit dry, but it is overall a fun read. Things are presented efficiently, and the author provides many examples and exercises from physics. This is a book heavily used in grad schools by physicists.
2. **Fecko's "Differential Geometry and Lie groups for Physicsts"**. What differentiates this book from others (on the same level as this) is that it's a mix between being a conventional textbook, explaining things in detail and providing examples, and an exercise book. Some important things are left to the reader to show/prove. The author almost always provides detailed guidance on this and if the exercise is important, he will also state what its conclusion is. This makes this book helpful to learn and at the same time develop your problem solving skills, but it can be quite frustrating if you aren't able to solve an important exercise that might use a technique not described in the book but will be needed later on. I guess depending on the person, some might find it a gem and others a pain in the ass.
3. **Frankel's "Geometry of Physics"**. Now, this book I like a lot. It provides a lot of intuition behind almost everything, even the more abstract concepts one has to grasp. It helps that the author uses a lot of figures to explain what's happening. On the other hand, there aren't many exercises to solve, but this can be amended by either combining it with Fecko's (more structured) book or by finding exercises on those topics online. My impressions are that this is the least rigorous book from all of my recommendations, but I might be mistaken. I do remember that for a physicist, the presentation found here is to-the-point.

As an extra, I will also mention a resource that's not a book but might be incredibly helpful. The video lectures "The geometrical anatomy of Theoretical Physics" by Frederic Schuller (found on Youtube) are an amazing resource for learning this topic. He is very lively, as rigorous as you'd want it to be for a theoretical physicist (maybe not a mathematical physicist though) and he is very thorough and explains things deeply. There are also lecture notes that accompany his lecture videos, which can be found easily on the net. Highly recommended.

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Modulname
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Literatur

• M. Fecko: Differential Geometry and Lie Groups for Physicists,
Cambridge University Press, 2006
• F. Hehl, Y. Obukhov: Foundations of Classical Electrodynamics, Birkhäuser, 2003
• K. Jänich: Vektoranalysis, Springer, 2005

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