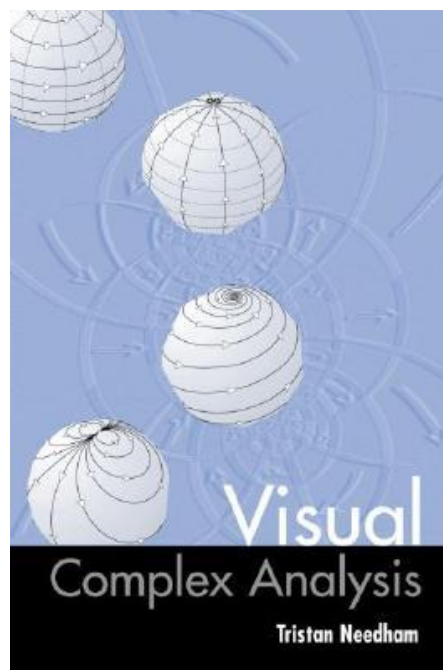




Visual Complex Analysis

Tristan Needham , Richard Feynman (Preface by)

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This radical first course on complex analysis brings a beautiful and powerful subject to life by consistently using geometry (not calculation) as the means of explanation. Aimed at undergraduate students in mathematics, physics, and engineering, the book's intuitive explanations, lack of advanced prerequisites, and consciously user-friendly prose style will help students to master the subject more readily than was previously possible. The key to this is the book's use of new geometric arguments in place of the standard calculational ones. These geometric arguments are communicated with the aid of hundreds of diagrams of a standard seldom encountered in mathematical works. A new approach to a classical topic, this work will be of interest to students in mathematics, physics, and engineering, as well as to professionals in these fields.

Visual Complex Analysis Details

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From Reader Review Visual Complex Analysis for online ebook

Ezra says

i bought this book for like \$76 at borders and i think the clerk thought i was insane (i suspected i was insane.) (clerk: "woah, that's an expensive book. what's it for?" "umm... for fun? i guess...???") buying shit is weird. i know i could get it on half.com for like 18.99 or whatever, but sometimes it just seems too fucked up to do that. i want someone, somewhere, to know that someone found this book browsing in a borders and immediately forked over the cash and walked out with it. things like this have value. affirming that value is at least as important as eating lunch at Togo's every day for five days. i feel the same way about buying music and crap, so whatever.

anyway, i got it because it instantly struck me as exactly what i needed right then. what better reason? the book is just what it says, which is more radical than it maybe seems at first glance: it is a course in complex analysis that is presented exclusively, doggedly even, from the standpoint of geometry. it kindof blew my mind. it's interesting to imagine (as the author does, in his introduction) that there was a time, before our modern concepts of mathematical "rigor" were really formulated, when enormous mathematical insights often arose from physical, spatial analogy, or equally "informal" means. what's fascinating is the idea of trying to recapture that kind of direct, intuitively guided reasoning. it is certainly not a very rigorous book; most of the "proofs" are informal geometric demonstrations; but i think it does its job: it convinces the reader of the intuitive "rightness" of mathematical truths that are very, very hard for most people to grasp at all; this is a very hard thing and i am duly impressed. dr needham makes no bones about his adherence to a philosophy that sez mathematical truths are TRUTHs in an absolute sense, "capturing aspects of a robust Platonic world that is not of our making," in stark contrast to the somewhat popularized Gödelian vision of mathematics as a rickety, self-referential structure of Relative Truths, which dovetails so nicely with the pseudo-postmodern philosophical and aesthetic pablum so lovingly spewed by art students and other priveleged twentysomethings desperately trying to forget their own consequences as a part of material reality... er, oops, i'm derailing...

um, i really like this. i could never imagine that such an approach to complex analysis would make so much sense, nor proceed with such clear logic. there are LOTS of exercises, which are quite varied, often difficult, and implicitly test one's (my) powers of computation to the utmost (in case you were worried by all the pretty pictures.)

it's hard for me to summarize this stuff much better. maybe a couple sample problems:

[ch. 1]

"by considering [geometrically?] the product $(2+i)(3+i)$, show that $(\pi/4) = (\arctan(1/2) + \arctan(1/3)).$ "

[ch. 2]

"the mapping $z \rightarrow (z^3)$ acts on an infinitesimal shape and the image is examined. it is found that the shape has been rotated by π , and its linear dimensions expanded by 12. where was the shape originally located? (there are 2 possibilities.)"

[ch. 10]

"show both algebraically and geometrically that the streamlines of the vector field z^2 are circles that are tangent to the real axis at the origin. explain why the same must be true of the vector field $1/(\bar{z})^2$."

fun!

and of course, the illustrations are AWESOME.

Nemo says

Found on Penrose's "Road to Reality" Bibliography.

I needed this book as a primer to non-euclidian geometry and complex integration.

Above all, you'll love how it feels when the author really wants that you really understand a so advanced topic.

Nishant Pappireddi says

I got this book because I was promised geometrically intuitive explanations of the results in a standard Complex Analysis course, and I was not disappointed! Almost every result the author stated was "proved" with a readily understandable geometric argument, which gave me a lot of intuition about why the results are true. Of course, the proofs were not rigorous, but that's what a Complex Analysis class is for.

Many other people have said that one should read this book only after completing a Complex Analysis course, but I don't think this is necessary: I read this book without taking a Complex Analysis class and after taking a rather poor Real Analysis class. In fact, I think this book is best as a supplement to a more rigorous class, since then one can get both intuition and rigor; the former helps a lot in understanding the theorems and applying complex numbers to geometry.

Zack Garza says

Comes at the task of defining calculus on complex functions from a primarily geometric viewpoint, which makes things intuitive and easy to follow.

Very approachable, even coming from an undergraduate background, although a bit of exposure to real analysis beforehand would definitely help elucidate some of the arguments.

Only downside - the figures can be a convoluted at times, and are often a page or two away from their respective descriptions or explanations. Needham also occasionally fails to mention which figure he's referencing, which can be a minor annoyance. Otherwise, very solid intro to the subject.

Yasuhiko says

This book allows me to think and use complex analysis! Visual image is very useful for human to think.

zltg says

This book is amazingly well written. The presentation is beautiful. The ideas are well presented and easy to understand, but nontrivial and deep. I cannot imagine how an introductory book on complex analysis can be better written. I'll have to read it again sometime.

DJ says

From a blog post I wrote just after picking this book up:

"Sweet Feynman has it been a fun last couple days! I picked up Tristan Needham's Visual Complex Analysis from the University of Waterloo library and this book has reminded me why I fell in love with math as a wee lad. The book's pedagogical approach is to teach math the way mathematicians actually think about it – visually. Needham's book is chock full of nifty pictures of Riemann spheres, conformal mappings, branches, and more. Complex analysis is an absolutely beautiful subject when couched in geometric terms and is accessible to anyone with a bit of calculus under their belt.

This was also a change of approach to learning for me. Usually, I get generally interested in a subject, pick a textbook, and read it cover to cover, doing the problems as I go. This time, however, my explorations in complex analysis were motivated by a very specific research application, so I dove right into the middle of the book to extract the particular pieces I needed.

I've noticed that I seem to learn much more quickly with an application in mind like this. Further investigations are needed, but this might hint at a more efficient and productive approach to learning for me – first, find a particular problem that requires the tools I'm interested in and then, go off and learn them. This is fun because every new topic I stumble upon in Needham's book gives me new insights into the problem I'm working on."

Dave Eaton says

It's rare that I would post a book like this as a recommended read. Clearly, it is not one for everybody. But it is, hands-down, the most engaging and delightful mathematics book I have ever encountered.

Needham likens modern mathematics to a hypothetical world where scholars study, discuss, and produce musical scores, but are never willing to play the music. In fact, the playing of music is suspect, somehow beneath the dignity of scholarly music. It doesn't take any effort to see how tragic this would be. Needham claims, and I think shows, that a similar thing has happened in mathematics.

Math has taken this attitude; the need for rigorous proof has driven illustration and picture-drawing out in favor of abstraction and exactness. Needham hardly argues against the need for rigor. But he argues, rightly I think, that the mind is fed, and the intuition prepared, by visual arguments. Visual beauty provides the motivation for the rigor that must come. Visual arguments can hint at where rigor must go.

Whether this is a valid path for mathematics as a discipline, I am not qualified to answer. But it is quite possible for someone with a background in typical, utilitarian higher math (by which I mean calculus through differential equations) to see vistas far more stunning and deep than one might have guessed existed.

Needham's book can do that for complex analysis, with effort on the part of the reader.

Ultimately, for a non-mathematician like myself, mathematics has to be either beautiful visually, or very useful, or I have no choice but ignore it. Needham shows in this delicious book just how beautiful and useful complex analysis is.

Edwin says

This book is a gem. If you want a feel for complex analysis and want to experience the motivation behind some fuzzy concepts that are introduced in terse texts, then this book is for you. This book will show you the beauty that is complex analysis.

Ronald Lett says

A beautiful exposition of the geometry behind complex analysis and topology! Assuming you have already been exposed to complex calculus, the great connections made in this text with modern geometry, topology and algebra will solidify your work with complex numbers as a geometrical language.

Mauricio Eguez says

Great way to approach complex analysis. I am not reading this book linearly, but rather using it to enhance my knowledge of complex analysis. A standard text in complex analysis is a good complement.

Jake says

"The Divine Spirit found a sublime outlet in that wonder of analysis, that portent of the ideal world, that amphibian between being and not-being, which we call the imaginary root of negative unity. " ~ Leibniz

As a undergraduate calculus student who hasn't taken his first contour integral, I must admit that I bit off more than I can chew with this book. That said if you aren't in over your head, how will you ever know how tall you are? As I approached the boundaries of my current knowledge with this book it gave me a lot of ideas on how to approach problems in new ways and I really appreciate the insights Needham gave me in such a short span of a mere two chapters. Using computers as a laboratory really makes me approach math in a different way than I had previously. Math for most of my academic career has been running a gauntlet, but opening up Mathematica and exploring these functions is really fucking cool. I particularly liked this example of the geometric series in chapter two. Such a simple instructional example of what is going on with that function and it answered many questions I had in my Calculus 3 course I took last winter. I plan on coming back to this book in the future, and might update this review then. As a CS major I have not run into any need for complex numbers and have more pressing subjects to read about at the moment.

(Review of the first two chapters)

Julius Chung says

This is the most enjoyable maths textbook that I have read.

The texts provided with the numerous illustrations offer an easy, intuitive introduction to complex analysis. With that said, most theorems in a first year complex analysis course are covered and I found it really helpful to follow up with a more traditional textbook on the details of the proofs.

Bernard says

This is a fantastic book on complex analysis, especially if you're more of a visual learner like I am. I highly recommend this to anyone interested in complex analysis, whether you'll be actively reading it or keeping it as a reference. Pair this with a book on the applications of complex variables to get the most out of it.

Amar Pai says

Really great book... the closest I've come to actually 'getting' complex analysis.

Basic operations like complex multiplication are clearly explained in terms of vector diagrams. Hyperbolic geometry, the Riemann sphere, the winding theorem and other topics really make a lot more sense explained in an intuitive visual manner. Needham created all the illustrations himself using CorelDRAW, LaTeX and the complex graphing program $f(z)$ (<http://www.lascauxsoftware.com/>). They are very nicely done and often quite elaborate. One gets the sense that a book like this wouldn't have been possible in an earlier era, as the tools allowing an author to generate hundreds of complex mathematical images did not yet exist.

No, the book's not always rigorous in its proofs, but to quote Needham from the book's preface:

My book will no doubt be flawed in many ways of which I am not yet aware, but there is one "sin" that I have intentionally committed, and for which I shall not repent: many of the arguments are not rigorous, at least as they stand. This is a serious crime if one believes that our mathematical theories are merely elaborate mental constructs, precariously hoisted aloft. Then rigour becomes the nerve-racking balancing act that prevents the entire structure from crashing down around us. But suppose one believes, as I do, that our mathematical theories are attempting to capture aspects of a robust Platonic world that is not of our making. I would then contend that an initial lack of rigour is a small price to pay if it allows the reader to see into this world more directly and pleasurably than would otherwise be possible."

If you've only seen traditional complex analysis textbooks, this style of exposition will come as quite the revelation. Needham really does a great job of it. I'd love to see future editions in 'e-book' style with animated/interactive versions of some of the diagrams in text (put it on an iPad and integrate w/ $f(z)$!)

I borrowed this book from a friend but ended up having to purchase it, cos I anticipate coming back to this over the years. Something to be savored at leisure.
