REFERENCES

This civil war era satirical novella not only humorously (and creepily) pokes fun at some social and political logic of the time (especially regarding gender roles), but it also provides a good discourse on the difficulty that engineers encounter dealing with the mathematics of geometry in higher dimension than we live in as human beings.


This is a standard reference for physicists. It provides brief and lucid overviews of many useful theorems in applied mathematics. If you find this reference too advanced, try first reading Wylie & Barrett, but be sure to come back and compare what they say with what this book says to solidify your understanding.


This paper provides the foundation for the iterative polar decomposition on page 604 here in our book. The B&B algorithm has stretch convergence limits, but our scaling in STEP 3 (which was not mentioned by B&B, but is proved in Ref. [15]) makes the algorithm converge for all invertible [F] matrices, no matter how large the stretch. When the cost of computing a convergence test is taken into consideration, we find B&B’s method to be faster and equally accurate as Higham’s [50] Newton solver (we have not tested Dubrille’s [34] recent refinements of the convergence test for Higham’s method, which might make Higham’s iterator equally fast).

Available at http://www.osti.gov/bridge/
This government report uses discretely measured stress-strain data to infer tangent stiffness tensors, where it is pointed out that such inferences entail irreducible uncertainty since the act of measuring the response to one stimulus loading increment generally involves irreversible changes in the microstructure, precluding knowing with certainty what the response would have been to a linearly independent loading increment. This observation provides a strong argument favoring investment in mesoscale modeling (where it actually is possible to reset the material state).

This paper illustrates pathological attributes in commonly used yield functions, and it provides three simple verification problems for verification testing classical nonhardening plasticity models.

This is an appropriate choice for follow-up reading to learn how tensor algebra formulas change in structure (not meaning) when a non-orthogonal, non-normalized, and/or non-right-handed basis system is used. This book explains the generalizations that must be included in calculus formulas whenever the basis vectors change with position (as in cylindrical or spherical coordinates).
REFERENCES

http://www.mech.utah.edu/~brannon/public/Rotation.pdf
This report, which is as large as a book, explains myriad ways to describe rotations (spinors, quaternions, Euler Angles, roll/pitch/yaw, etc.), along with discussions of physical problems that require rotations (PMFI, rigid mechanics, etc.). Rotations in higher-dimensional spaces (tensor space) are covered, which has applications in plasticity theory.

This book chapter provides a summary of classical rate-independent and rate-dependent (overstress) plasticity.

This is an extensive student’s guide to Mohr diagrams for both symmetric and skew-symmetric tensors.

This small hand-out defines the basic formulas used in gas dynamics, and provides recursion tables that you may use to convert any thermodynamic derivative into a form involving only tabulated material properties and measurable state variables.

This paper has two distinct parts. The first half is a rather arcane discussion shock admissibility conditions. The second half derives the complete set of eigenvalues and eigenvectors for the acoustic tensor associated with general plasticity, with a discussion of the implications for porous material models.

This paper presents an EXACT solution for stress as a function of the deformation gradient tensor for the very idealized problem of parallel fibers in a negligibly weak matrix (fibers in air). This exact solution is used to illustrate merits and flaws of common approaches to large distortion kinematics.

This paper presents an EXACT solution for stress as a function of the deformation gradient tensor for the very idealized problem of parallel fibers in a negligibly weak matrix (fibers in air). This exact solution is used to illustrate merits and flaws of common approaches to large distortion kinematics.

This is a passable reference on advanced calculus. You will need a solid foundation in advanced calculus to make good progress learning functional analysis.


This book is packed with lots of nifty tidbits and unusual perspectives that will broaden your understanding of continuum mechanics and tensor analysis.


This paper uses a philosophy similar to ours in a discussion of basis mathematics of fourth-order linear transformations.

This wonderful two-volume book is organized as a sequence of small (usually half-page) summaries of topics in mechanics. If you need to learn a topic quickly, this book works well because you don’t have to read all of it to understand these mini-chapters.
REFERENCES


A great (and blessedly small) book on basics of tensor analysis for non-orthonormal bases (exposing you to contravariant and covariant components, as well as curvature, Christoffel symbols, and similar notational complications that are not covered in our introductory volumes). Such concepts are important to learn early in modern physics.


This article illustrates that anisotropy induced in isotropic materials is non-negligible if the material has strongly pressure-dependent strength. The fact that isotropic materials generally have an anisotropic stiffness has long been recognized in the rubber and biomechanics communities, probably because they are able to achieve large deformations with small loads. The concept is less well understood among metals and ceramics researchers, for whom large deformations are typically achieved only in shock loading, which precludes direct measurement of stiffness. The need for induced anisotropy reveals itself indirectly when data reveal the need for a pressure-dependent shear modulus.


[41] Gelbaum, B.R. and J.M.H. Olmsted (1964) *Counterexamples in Analysis*. Holden-Day, Oakland, CA. This seminal work, mostly focused on functional analysis, drives home the power of counter-examples as a means to prove that something is NOT true.


A wonderful book, casually and humorously written, and packed with information that is useful to the practicing engineer. Some people prefer this edition to more recent releases. Considering how much information is in this book, it is relatively short because considerable details are “left to the student” in exercises. Consequently, get a solutions manual if you can.


This book (and a later edition with coverage of thermomechanics) has good interpretations of the principle of material frame indifference, especially on the application of momentum conservation in non-inertial frames. It’s a bit choppy in its coverage of specialized topics (the assumptions that limit scope of certain chapters are not always clear).

This author also publishes under the name Mackenzie-Helnwein. This paper makes the important point that conventional Voigt compact matrix representations of higher-order tensors are, in fact, defining components of those tensors.
with respect to an underlying basis that is not orthonormal. Hence, Voigt components are usually either covariant or contravariant, in which the confusing factor or divisor of 2 in the Voigt system is actually a “metric.”


This is seminal work on classical plasticity.


This paper points out how the Cayley-Hamilton theorem may be used to perform a polar decomposition in algebraic closed form. This paper contains errors in its formulas for finding invariants (corrected later in Ref. [80]), but the basic notions are sound.


This book is very popular, especially in biomechanics, and it includes an accessible and lucid introduction to tensors and continuum mechanics (with only minor rough spots in the coverage of the principle of material frame indifference).


Lucidly written, this book contains coherent (readable) proofs of theorems that most other books “leave to the reader”. An excellent resource.


This paper has some useful discussions, but it fails to use self-defining notation. For example, it uses the cross product symbol to denote dyadic multiplication, while it uses the dyadic multiplication symbol to denote what we call “leafing” multiplication. It claims as “new” some operations and results that had been around for twenty or more years earlier.


New students to the subject seem to like this book, which is surprising since it uses somewhat old-fashioned (and certainly not self-defining) notation. For a continuum book, perhaps excessive coverage is given to small-deformation analysis methods that are taught in undergraduate materials mechanics courses.


This book is a pretty good introduction to tensor analysis. This book would be comprehensible to undergraduates, which alone makes it worthy since so many of the books out there can only be read by mathletes. This book’s has a few quirks, but nothing outrageously bad. The book includes a very nice introduction to differential geometry. It covers curvilinear coordinates too.


This is one of the best known references on elementary continuum mechanics. It is difficult for most people to learn continuum mechanics for the first time from this book, but after reading a simpler book first (e.g., Mase-Smelser-Mase), Malvern’s book can be an indispensable reference.
REFERENCES

This very readable introduction serves as an excellent starting point for newcomers to continuum mechanics. Like many continuum textbooks, it is somewhat dry with generic sketches (to convey generality of the concepts), but it would benefit from a few more specific applications.


This book might be a bit difficult for an engineer to read, but after you use Ref. [15] to learn the basics, you will find proper rigorous discourse about the same topics in this book.


This is a classic linear algebra textbook (especially used in the 1980s and 1990s).


This book uses the same "no symbol" notation for dyadic multiplication that we espouse. This book also has excellent succinct chapters on matrix and vector analysis.

Don't let the word "chemical" dissuade you from looking at this book. Here, you will find proper statements of key theorems from analysis that apply to all branches of engineering.


For engineers, this book is extraordinarily difficult to read. However, if you ever want a truly proper statement of a theorem, along with a careful list of underlying assumptions and mathematical domains of applicability, then this is the place to look.


This paper corrects errors in Ref. [53].

This ASME standard essentially formalizes the distinction between good mathematics, in which you are solving the equations correctly, and good physics, in which you are solving the correct equations.


Both Simo and Hughes are brilliant mathematicians. They approach every problem with impeccable ratiocination. You
will find reliable algorithms in this book. Unfortunately, however, this work is chronically lacking in basic everyday insight. For example, they provide an algorithm for the polar decomposition that requires computation of some initial "helper" variables. NOT ONCE do they inform the reader that these helper variables are just the standard $J_2$ and $J_3$ invariants. Their derivations are needlessly complicated. In their efforts to always present at least second-order accurate integration algorithms, they neglect to discuss the subtle issues of even first-order algorithms.


Contains theorems that are useful in generating the mesh of the sphere.


The title says it all. This paper shows the most general quadratic form that can be constructed from the isotropic invariants for a crystal class.


Derives the integrity bases for arbitrary numbers of vectors and tensors for (i) full orthogonal group (ii) proper orthogonal (rotation) group, (iii) transverse isotropy, and (iv) crystal classes.


This is a difficult book for the typical engineer to read because Stakgold rarely spells out the meaning of the equations. If, however, you are adept enough to figure this out yourself, then the effort to plow through this book is worth it because, by the end, you will think about functions and transformations in an entirely new way. You will be left with the habit of seeing everything as an operation (which, by the way, is the premise underlying Mathematica), and you will routinely apply Stakgold’s operation categorization.


Great resource for computational linear algebra!


Because of its many physical examples, this is a good engineer’s and physicist’s reference.


This is a very nice summary paper.


To our knowledge, this is the earliest reference that points out that Reynolds transport theorem is nothing more than a specific instance of the (more general) Leibniz theorem. Even modern textbooks fail to mention this illuminating fact.


This paper is relevant to computation of the polar decomposition, which requires the “square root” of a tensor.


This paper shows how to derive transversely isotropic constitutive relations using integrity basis for the transverse orthogonal group of transformations.
REFERENCES


Even though *Mathematica* caters to mathematicians, the basic premise upon which this symbolic math program is based (namely, that *everything* is an operation) is so useful that engineers would be well served to embrace it as well.


For engineers, this is a great resource book. It has summaries of numerous branches of mathematics, along with brief explanations of how to apply the mathematics to engineering problems. Consider using this book in conjunction with Refs. 3, 45, and 75.


[105] The Way of Analysis
