APPENDIX A
GOOD BOOKS

If you're going to build electro-optical systems for a living, you're going to have to change fields a lot. If you're still in school, use the opportunity to broaden your expertise—an optics or experimental physics student should learn signal processing and circuit design, and an electrical engineering student, classical and quantum mechanics. It's well worth devoting an extra semester to, if you can afford it—graduate students usually can. The rest of us need good readable books that don't demand total devotion.

The present author's usual way to start learning a new field is to get a good undergraduate-level textbook and read it like a novel. Pay special attention to getting the very basic concepts down perfectly; as we've seen in earlier chapters, our confidence in working in a new area depends entirely on how sure we are of our tools. For example, Fourier optics is an approximation, but the Fourier decomposition of an optical field is exact; in electronics, metal resistors are linear and have only Johnson noise, and capacitors subtract DC noiselessly. In this class also are the classical techniques of other fields. For instance, the use of UHF modulation to suppress mode hopping in diode lasers is an idea first used around 1930, in the quench circuits of superregenerative receivers. (Superregeneration is an amazingly cute idea—you can amplify the Johnson noise enough to drive headphones with a single low-gain stage; see Terman, Radio Engineering.) Thanks are due to the assembled expertise of the Usenet groups sci.optics, alt.lasers, and sci.electronics.design for suggestions and criticism. Those are also excellent places to find electro-optical design help. One thing to remember about Usenet technical groups: the crisper the question, the more helpful the answer, in general.
Legend:

- Introductory level: Accessible to technical people from outside the field
- Intermediate: Advanced undergraduate level, some background required
- Advanced: university-level preparation required.
- Available free online

MATHEMATICS


I. M. Gelfand and S. V. Fomin, *Calculus of Variations*, Richard A. Silverman, translator, Prentice-Hall, 1963. Variational methods are a uniquely powerful way to get solutions to a lot of problems in electromagnetics and mechanics, which lead straight to useful algorithms. Short, accessible and has all the variational horsepower you’re likely to need. 📖📖

Roger A. Horn and Charles R. Johnson, *Matrix Analysis*, Cambridge University Press, 1987. Covers advanced linear algebra topics, such as singular value decomposition, condition numbers, and so on. It’s a math book, all right, but it’s nice and clear, and states results in algorithmically useful forms. 📖📖


MATHEMATICAL TABLES


**ELECTROMAGNETICS**


**OPTICS**

Nicolaas Bloembergen, *Nonlinear Optics*, Fourth edition, World Scientific, 1996. (Reprint of 1965 edition with updated references.) The best books are usually written by the pioneers, and Bloembergen is an excellent example: clearly written and physically lucid.


OTHER PHYSICS


CIRCUITS


Ralph S. Carson, *High Frequency Amplifiers*, Wiley, 1982. A lucid explanation of S-parameter design of high frequency amplifiers, based on Smith charts. This is how you really do it.

Floyd M Gardner, *Phaselock Techniques*, Third edition, Wiley, 2005. All about analogue phase-locked loops, including frequency synthesis, PLL signal detection, telemetry, and Doppler tracking. Just the right amount of math so you can do it yourself.  


Mac E. Van Valkenburg, *Reference Data For Engineers*, Eighth edition, Howard W. Sams, 1995. Lots of practical stuff about design of RF, communications, analogue and digital circuits. This edition branches out from the previous radio-only focus, but still has a lot of great RF stuff.  


**NOISE AND INTERFERENCE**  


**OPTOMECHANICS**


**DETECTION AND FRONT ENDS**


**MEASUREMENTS AND SYSTEMS**


**CONSTRUCTION**


LASERS


Anthony E. Siegman, *Lasers*, University Science Books, 1986. Covers all aspects of lasers at a first year graduate level; accessible and full of good intuitive examples. Due to its age, better on gas and solid state lasers than diodes. ⬤ ⬤

DIGITAL SIGNAL PROCESSING AND NUMERICAL ANALYSIS


Dennis C. Ghiglia and Mark D. Pritt, *Two Dimensional Phase Unwrapping*, Wiley, 1998. 2-D unwrapping is a ubiquitous and very thorny problem; G&P gives the gory details for times when the seat-of-the-pants approach fails. ⬤ ⬤ ⬤


analysis book that comes with a lot of working code you can use right away. There's a third
(C++) edition, but the second (C) edition is available free, and the C routines may be easier
to integrate with your code. 

with a fair amount of lore and good insights on when to use the different algorithms.

Anthony Ralston and Philip Rabinowitz, *A First Course in Numerical Analysis*, Second

Steven W. Smith, *The Scientist and Engineer’s Guide to Digital Signal Processing*. An elementary DSP book with a wide coverage, lots of pictures and discussion, cookbook tables,

**HANDBOOKS WORTH HAVING**

(8 volumes), Infrared Information, 1993, also available for download from http://www.dtic.mil.
All kinds of tables and discussion—not as handbooks as most others.

find out that the night sky has ~0.1 naked-eye visible stars per square degree?

Michael Bass et al., editors, *Handbook of Optics* (4 volumes), Optical Society of America
II Devices, Measurements, and Properties; Volume III: Classical, Vision, and X-Ray Optics;
and Volume IV: Fiber Optics and Nonlinear Optics. Truly gigantic—not the last word on
any optical subject, but a good place to start for most.

that started it all. Still very very useful, and free.

A huge book full of tables, indispensable for mixed-technology systems like EO systems:
the ‘rubber bible’ has lots about materials, including enough optical properties that you may
not need Palik & Ghosh. Recent editions are much better than the old ones.

G. W. C. Kaye and T. H. Laby, *Handbook of Physical and Chemical Constants and Some
handbook, very useful when you have to choose materials, or calculate heat transfer—it has
obscure things like the specific heat and thermal conductivity of tantalum wire.

detailed critiques of how the constants were measured.

1985. Lots of good tables and curves make this a useful handbook for designers.