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DIY

-online-

TUBE AUDIO

RESOURCE GUIDE

RESOURCE GUIDE

Congratulations, you've found the *No-Load Guide to Online DIY Tube-Audio*. It is a work in progress. You certainly can't replace books at this point in time but you can certainly learn enough to DIY an amp and introduce yourself to the basic concepts. Please consider this a community project and bring online resources I have overlooked, dead links, and obvious blunders to my attention. If you know of a site that would supplement these materials, or have something to add, your input is welcomed.

Contact: Craig at wryder@chartermi.net

Thanks to all those folk mentioned below who have made their stuff available online. (I've tried to contact everyone named below but was not always successful. If you would like your site removed from the Guide send me an email.)

Obligatory Warning

(Beauty and the Beast)

It may seem odd, but an amp whose greatest virtue is its ability to run on the first few thousandths of a watt and make beautiful music... ??

CAN KILL YOU.

C'est la vie

I. General-Introductory articles. These are all short and, for the most part, non-technical. There is a fair amount of repetition through some of the articles but hey, maybe that means it's important. The British National Valve Museum is a beautiful site.

1) *A Taste of Tubes (50 pages)*, Sonic Frontiers:

<http://www.anthemav.com/OldSitev1/frames/tubesfr.html>

2) *The National (British) Valve Museum*. <http://www.r-type.org/static/.contents.htm>

3) *The Cool Sound of Tubes*, E. Barbour: www.spectrum.ieee.org/select/0898/tube.html.

4) *How A Vacuum Tube Works*, E. Barbour: www.svetlana.com/docs/tubeworks.html.

5) *Vacuum Tube Valley FAXs*, E. Barbour: <http://www.vacuumtube.com/FAQ1.htm>

6) *Vacuum Tube FAX*, H. Pasternack: <http://home.earthlink.net/~busenitz/vac.html>.

7) *A History of Tube Companies*: <http://vintagetubeservices.com/page8.html>

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8) *Vacuum Tube Primer*, R. Hamm:

<http://www.audioasylum.com/audio/faq/tubeprimer.html>

II. Beginner/Intermediate Tube Audio Electronics: The goal of Section II is to present online materials that will provide the beginner with an overview of the basics of electricity and tube-audio electronics.

“You’d be surprised how much you can learn by rereading the same article ten times over a two year period. Treat this book the same way.” Bruce Rozenblit, from his book, *Beginner’s Guide To Tube Audio Design*, p17.

A. Basic materials. Presented roughly in order of difficulty. **The *LEC* and *NEETS* materials below cover the basics** of electricity and tube circuits. The (.) stuff, as a group, covers basic concepts. The (.) stuff is especially good. Hopefully you want to read everything else too, but until you get a little grip on some basics it’s a little like carrying water with a hole in your bucket – the farther you go, the less you have to show for it when you get there.

1) Secrets of Home Theatre: *Amplifiers*. A really basic overview.

http://www.hometheaterhifi.com/volume_1_1/v1n1amps.html#TypesofTubes

2) . Ray Dall, *Electronics Theory.com*.

<http://www.electronicstheory.com/html/e101-1.htm>. Some basics on circuits about as briefly as is possible. *Electronics Theory* is a complete course for folks who only want to spend a few hours on the subject and a good starting point for those who want to go further. About 50 short pages. A helpful overview of tubes begins on page 37.

3) . Randall Aiken, *A Glossary of Common Amplifier Terms* : Why do they call it B+ and what is it anyway? Mr. Aiken provides a few clear definitions of some basic terms you need to know. <http://www.aikenamps.com/AmpTerms.html>

4) . Randall Aiken, *Introductory (Beginner’s) Technical Papers*:

http://www.aikenamps.com/TI_Aiken_int.htm Nine short papers. At least read his short piece on voltage dividers. Aiken is primarily a guitar amp guy but the principles are the same and he writes well. IMHO Aiken’s “tech info” section is one of the best on the web.

5) . Tony R. Kuphaldt, *Lessons in Electric Circuits (LEC)*:

<http://www.ibiblio.org/obp/electricCircuits>. *LEC* offers more detail than *Electronics Theory.com* (above). There’s not a tube in the book, but you won’t understand tubes without understanding electricity. Printable formats at link above. Volumes I and II are most relevant. Links to the Chapter Titles and texts of Volumes I, II and V are given below so you can easily see what’s there. *LEC* and *NEETS* (immediately below) together

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provide a general picture of basic tube electronics. (If you have a better online source please let me know.)

Volume I (dc): <http://www.ibiblio.org/obp/electricCircuits/DC/index.html>.

Volume II (ac): <http://www.ibiblio.org/obp/electricCircuits/AC/index.html>.

Volume V (Ref): <http://www.ibiblio.org/obp/electricCircuits/Ref/index.html>.

(Hint: have a couple reams of paper if you want to print)

Unfortunately, while you can link the text from the chapter titles, the indexes are not available by link for a quick look. You have to download the files and print them out. If you don't know a time constant from a sweet potato you might want to print a lot of this book and read a good portion of it straightaway anyway. But you can also use it for a reference. An excellent table of contents and index is located at the front and back of each volume. For example, if you have a question about Aiken's short piece on voltage dividers (immediately above) look at the Chapter Title links above. Vol. I, Chapter 6, is titled "Divider Circuits." Read that for more detail. However, some things aren't so easily located by chapter titles and the indexes can be very helpful.

Volume V is a collection of useful material: formulas, schematic symbols, standards, conversion tables, Spice tutorial, etc.

6) . *Navy Electrical Engineering Training Series (NEETS)*: <http://www.tpub.com/neets>.

Some basics on tube circuits. The sections, "Introduction to Electronic Emission, tubes, and power" and "Introduction to Alternating Current and Transformers" are most relevant but others are good too. All sections begin with indexes of subjects covered. Tubes are discussed a lot. This material can be printed in the non-pdf format but you waste some ink. You have to pay in order to access the pdf.version at this site. (See below)

Index-link: Intro to AC and Transformers: <http://www.tpub.com/neets/book2/index.htm>

Index-link: Intro to Electron Tubes: <http://www.tpub.com/neets/book6/index.htm>

Index-link: Intro to Amplifiers: <http://www.tpub.com/neets/book8/index.htm>

A few of the NEETS materials are available in pdf. format (no color, a few changes, but **easier to print**) w/o charge. **NOTE:** I cannot link the NEETS materials below directly from Word on my computer (some people can). **If the link fails because of "security reasons" just copy the link below, enter your browser, and paste the url in the address space.** Everybody seems to be able to link it directly from a browser. All three chapters are good. Intro to Electron Tubes and the Power Supply piece are very good if you are a beginner.

. *NEETS: Intro to Electron Tubes, Power Supplies, and Specialty Tubes* in pdf. (easy to print) format. 204 pages.

<https://www.advancement.cnet.navy.mil/products/catalogpages/14178.htm>

Note: you can usually buy the cd version of NEETS on Ebay for about \$5.

7) . A little more about tubes.

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. *RCA Radiotron Tube Manual, No. R-10* (from Tim Reese's site)

The First 25 pages or so gives a nice classic overview of tube theory, how RCAs were made, plate curves and operating characteristics of tubes (mu, amplification, transconductance). <http://www.nmr.mgh.harvard.edu/~reese/RC10/rc10.pdf>

. John Harper, *Tubes 201, How Vacuum Tubes Really Work*: a very nice modern and more detailed overview of what goes on in a tube. <http://www.john-a-harper.com/tubes201/>

Want to be a tube expert? John Harper mentions Karl R. Spangenberg's classic book, *On Vacuum Tubes*, for further reading and notes that the book is "extremely difficult to get hold of." Fortunately, it is available at Ken Gilbert's site online. Grad students at Stanford studying vacuum tube design in the 1940s used it. <http://ken-gilbert.com/spang/spangenberg.html>

* Glass Audio (Tube Cad Journal), *Live Curves Dynamic Plate Curves FREE software*: <http://store.yahoo.com/glass-ware/tubjourcomso.html>. Click the "Live Curves, Dynamic Plate Curves" section. This is a nice little free program for the 6H30 valve. It lets you see instantaneous changes of tube circuit parameters. You may never use the tube but it gives you a clear idea about how loadlines work and how things interrelate for this valve.
**Check out the "Tube Cad" and "SE Amplifier Cad" software too (for a slight fee). It lets you do a lot more of the same thing for tube circuits.

8) Audiomatica *Tube Directory*: Nice presentation of some helpful info about a few common tubes. The plate curves, pin geometry and specs should all make some sense by now. If not, do not pass go, do not collect \$200. Go back and read some of this over again. <http://www.mclink.it/com/audiomatica/tubes/el34.htm>

9) . Army Tech Manual TM11-670 (from R.Aiken's site), *Amplifier Fundamentals*: <http://www.aikenamps.com/ampfund.pdf>. A discussion about biasing, amp class, and distortion.

10) . Randall Aiken, *Designing Common Cathode Amps*:
www.aikenamps.com/CommonCathode.htm

10.5). John Broskie (Tube Cad Journal) goes "back to tube kindergarten" for his first 2003 article and writes about what he calls the basic "building block" of tube amplifiers: The Grounded Cathode Amplifier:
http://www.tubecad.com/articles_2003/Grounded_Cathode_Amplifier/Grounded_Cathode_Amplifier.pdf

11) . Jim DeKort, *Choke vs. Resistive Loads*:
http://www.vt52.com/diy/tips/tips_chokeload.htm

12) . Max Robinson, *The Resistance Coupled Amplifier, a Basic Building Block*:
<http://www.angelfire.com/electronic/funwithtubes/Amp-RC.html>

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13) A couple words on Push-Pull circuits

. Mannie Horowitz, *Push-Pull in Hi-Fi*. Simplified PP Theory (from Pearl Audio):
http://bulk.pearl-hifi.com/02_PEARL_Arch/Vol_01/Sec_1/0010_Push_Pull_in_HiFi.pdf

. Gabe Velez' Magnavox knock-off PP Amp:
<http://members.tripod.com/~gabevee/pptube.html>
<http://members.tripod.com/~gabevee/maggie.html>

B. A few DIY sites that have excellent sections geared to Newbies that deal strictly with audio tube electronics:

1) . Claudio BonaVolta's Tube Audio: General index here:

<http://www.bonavolta.ch/hobby/en/audio/index.html>

An index to discussions of coupling, bias, power stages, amp classes, phase splitters and more is found in his "Tubes For Newbies" section, here:

http://www.bonavolta.ch/hobby/en/audio/t_bas.htm

2) . Gabe Velez' site: General index here:

<http://members.tripod.com/~gabevee/index.html>

An index to Gabe's "Technical" section with nice short pieces on capacitors, resistors, transformers, inductors, negative feedback, and bias is here:

<http://members.tripod.com/~gabevee/ezindex.html>. Read "One Tube First Time Amplifier" and "First Amplifier Revisited" too. It brings some of this together.

3) . Bottlehead "Loose Parts": <http://www.bottlehead.com/loosep/loosep.html>

Take a look at Voltsecond's site, Quest's site, Joe Yellico's fine animations, etc.. for hands-on practical advice about wiring, soldering, and audio electronics, etc. The common effort found here with the "Foreplay" pre circuit is one of the best and most thoroughly documented efforts online for the beginner. Bang for the buck too.

MISC INTRO Materials: These are sites I have not had time to edit into the mix but did not want to leave out. They are worth looking through. Kind of a holding tank.

General Electronics:

**Massachusetts Institute of Technology, Intro to Electronics*: Change the number in "Lec1" part of the address. Use 1-13 for thirteen chapters from MIT for the brainiacs in the crowd. <http://web.mit.edu/6.071/www/lectures/lec1.pdf> Chapters include 1) Basic Concepts in Electricity, 2) DC Circuit Analysis I, 3) DC Circuit Analysis II, Nodal analysis, power transfer, 4) DC Circuit Analysis III, Thevenin and Norton equivalents, 5) Capacitance, 6) Inductance, 7) AC Sinusoidal Steady State, 9) Time Domain v Frequency Domain, 10) Resonance, 11) Fourier Series and Transform, 12) Information Concepts and the Uncertainty Principal, 13) Diodes

* *Boston Univ. Intro to Electronics* (Physics dept): <http://physics.bu.edu/py106/Notes.html>

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*Basic electricity, Electronics and More http://members.tripod.com/afd_/baselect.htm

*Graham Knott's Basic Electronics (Cambridge Regional College) Excellent!

<http://homepage.ntlworld.com/g.knott/index1.htm>

*Scots Guide to Electronics (U. of St Andrews) http://www.st-and.ac.uk/~www_pa/Scots_Guide/intro/electron.htm

* Electronics Tutorials .com. Includes a nice basic section on small signal amplifiers, filters, and other stuff too. <http://www.electronics-tutorials.com/>

* Basic Electronics (don't let "car" foolya)
<http://www.eatel.net/~ampstech/elecdisc/caraudio.htm>

Tube Electronics:

*Pearl, Notes on Tubes: http://www.pearl-hifi.com/06_Lit_Archive/Lit_Archive.html

*Max Robinson's, Fun With Tubes:

<http://www.angelfire.com/electronic/funwithtubes/#amplifiers>

*Design Techniques: http://digilander.libero.it/paeng/design_frame.htm

*Introduction to Vacuum Tubes:

<http://www.eecs.umich.edu/~mmccorq/tubes/introduction/introduction.html>

*Thermionic Valves: <http://www.mc-h.demon.co.uk/vtheory/vtheory.htm>

*Chris Hill's Electronics page: <http://www.hills2.u-net.com/home.htm>

C. Articles: Intermediate-Advanced. All of the following materials can be printed out and that is really the only way to use them.

1) . Randall Aiken *Advanced Technical Papers*:

http://www.aikenamps.com/TI_Aiken_adv.htm. 24 papers. Aiken is known for his great guitar amps and will talk about guitar amps along the way. No problem. Aiken writes clearly and the principles (if not all aspects of design) are the same. His "tech-info" section is great. Let's hope he keeps writing. Here are a few of his papers to peak your interest. **See his site for the other articles.**

-Designing Common Cathode Amps: www.aikenamps.com/CommonCathode.htm

-Vacuum Tube Amplifier Circuits and Equations: www.aikenamps.com/Equations.htm

-What is Miller Capacitance: www.aikenamps.com/MillerCapacitance.html

-Output Transformers Explained: www.aikenamps.com/OutputTransformers.html

2) . Norman Crowhurst. It is almost impossible to exaggerate the importance of Crowhurst's writing. Thanks to those who have gone out of their way to bring his writing online. **Some articles take a while to load.**

Audio Handbook (Crowhurst) at Richard Sear's Site

-General Index: http://richard984.tripod.com/vacuum_tube_literature.htm

-Chapter 1(Distortion, Load lines, Bias): <http://richard984.tripod.com/ch1.pdf>

-Chapters 2-4: (Instability, Regulation, Gain): <http://richard984.tripod.com/ch2345.pdf>

-Chapters 5-8: (Hum, Screening, Noise, IM): <http://richard984.tripod.com/ch678.pdf>

-Chapters 9-10(Z matching, FB, Damping): <http://richard984.tripod.com/ch910.pdf>

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-*Puzzled About Amplifiers?* (Crowhurst) at Randall Aiken's Site
http://www.aikenamps.com/Crowhurst_blocking.pdf

-*Some Defects in Amplifier Performance not covered by Standard Specifications* (Crowhurst) at Daniel Cheever's Site:
<http://web.mit.edu/cheever/www/crow1.htm>

-*Designing Your Own Amplifier*: at AudioXpress Site
-General Index: <http://www.audioxpress.com/resource/audioclass/index.htm>.
-*Voltage Amplifier Stages*: <http://www.audioxpress.com/resource/audioclass/ga699ac.pdf>
-*The Power Stage*: <http://www.audioxpress.com/resource/audioclass/ga100ac.pdf>
-*Phase Inverters*: <http://www.audioxpress.com/resource/audioclass/ga200ac.pdf>
-*P-P Power Stages I*: <http://www.audioxpress.com/resource/audioclass/ga300ac.pdf>
-*P-P Power Stages II*: <http://www.audioxpress.com/resource/audioclass/ga400ac.pdf>
-*Feed Back Amplifiers*: <http://www.audioxpress.com/resource/audioclass/ga600ac.pdf>

3) Joseph Marshall, *Practical Audio Design*: at AudioXpress Site
-General Index: <http://www.audioxpress.com/resource/audioclass/index.htm>
-PTs and Rectifiers: <http://www.audioxpress.com/resource/audioclass/ga399ac.pdf>
-Power Supply Filters: <http://www.audioxpress.com/resource/audioclass/ga499ac.pdf>
-Decoupling Networks and Voltage Regulation:
<http://www.audioxpress.com/resource/audioclass/ga599ac.pdf>

4) Brookdale Community College, *Electric Circuits Course*.
<http://www.brookdale.cc.nj.us/fac/engtech/aandersen/elt111/tutorial/index.html>
Non-ideal voltage sources, Network, loop and Nodal analysis; Thevenin's and Norton's theorem (equivalent circuits). This is good but I've seen printed texts that handle this better, See section XIV of this outline or *LEC*

5) . Tube Cad Journal: *Lowering the SE Amps Output Noise*: TCJ is invaluable:
<http://www.tubecad.com/april99/page2.html>

6) . Steve Bench, *Of Load Lines, Power Output and Distortion*:
<http://members.aol.com/sbench102/po-dis.html>. "Loadlines link the amp circuit to the anode characteristics ...this is the single most useful piece of analysis that can be performed on a valve stage." Morgan Jones, *Valve Amplifiers*, 2nd ed., pgs. 63-4. This piece also serves as an intro to one of the best advanced DIY sites on the Web.

7) . Radau5: *The Basics of Vacuum Tubes*. A collection of articles from the 1950-60s. Approximately 14 books. A lot here! Some of it is more advanced. Perhaps the last of this little section I would tackle. http://www.radau5.ch/basics_1.html

D. Useful software for starting out. This is not even the tip of the iceberg of software available online.

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- 1) *Circuit Maker 2000 Student edition*. Download this student edition circuit simulator free. Works good for drawing schematics too. You can add tube models. Open the Tetrode.sub or Triode.sub files with Notepad, paste in the Berkley 3f4 SPICE models (from Duncanamps.com for example). <http://www.microcode.com/index.html>
- 2) Bob's, *Capacitive and Inductive Reactance vs. Frequency Chart/Calculator*: <http://home.new.rr.com/trumpetb/audio/XLXCjs.html>
- 3) *Several Calculators*. Includes speaker filters, LC reactance, room reverberation. http://www.mhsoft.nl/spk_calc.asp
- 4) *Tube Cad and SE Amplifier Cad*: Helpful software from the Tube Cad Journal and John Broskie: This is the only thing I've listed that cost \$\$\$. Tube Cad Journal offers so much for free that it should be supported when it offers quality software. http://www.glass-ware.com/Audio_Software_Descriptions.html

III. DIY Sites and a few projects/schematics.

A. Sites Tried to pick a few DIY sites that you really shouldn't miss if you are starting out. "Unplug it, discharge it, measure the voltage on it, then work on it." VoltSecond.

Without further ado, we give the floor to Uncle Ned for "A few nuggets of potential wisdom." (and schematics too) <http://www.triodeel.com/dusty.htm>

- 1) Take a look at the other parts of *Gabe's* and *BonaVolta's* sites (above).
- 2) *Bottlehead Looseparts Section*: <http://www.bottlehead.com/loosep/loosep.html>. If you are looking for a first project this site is highly recommended for value, support, and quality. There is a great forum there too.
- 3) *Joseph Esmilla*: <http://users.starpower.net/je2a3/welcome.htm>. Inspirational. Take a look at the Simple 45/2A3 circuit and learn how to make the most of a Hammond transformer. ***Also check out *Derek Walton's* JE Labs 300b project. A really excellent presentation of Joseph Esmilla's 300b. <http://indigo.ie/~walton/300b.html>
- 4) *Single Driver Website*: <http://melhuish.org/audio/index.htm>. Best source for advice on efficient single driver speakers. Site includes tried and tested high efficiency speaker projects, great links and a forum. Invaluable. Thank you James Melhuish.
- 5) *TG's*: <http://www.users.bigpond.com/aagreen>. Nice projects that include some of the most popular DIY projects: Electric Tonalities' (Bottlehead) Foreplay pre and Bruce Rozenblit's grounded-grid pre, Welborne's 300b and one of Rozenblit's OTL amps - all with a touch of home cooking.
- 6) *The Fi Primer*, J. C. Morrison: <http://tinpan.fortunecity.com/saints/668/primer/index.html>

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7) VT52, Jim De Kort: <http://www.vt52.com>. An Excellent collection of Jim's projects and other DIY from all over the world. Don't miss the "tips and tricks" section located in the DIY section. Includes info/datasheets about a lot of cool and unusual tubes too.

B. Projects worth a study. These are especially good presentations where the maker/designer has made a nice effort to discuss and explain the project/circuits. All worthwhile designs too.

*** *Fred Nachbar's Mini-Blok SET*

<http://www.dogstar.dantimax.dk/tubestuf/miniblok.htm>

Fred has lots of info and provides a nice explanation of the circuit.

* *Jeremy Epsteins's Fee Lunch Direct Coupled 2A3*. A nice SET circuit and a very nice online reading list to help explain it. <http://home.earthlink.net/~ellenoler/freelunch.html>

* *Derek Walton's JE Labs 300b project*. A really excellent presentation of Joseph Esmilla's (JELabs) SE 300b. <http://indigo.ie/~walton/300b.html>

C. "Advanced" Excellent DIY sites. Good projects and great links too. (Note: I cannot possibly list all the worthwhile sites without this reading like "War and Peace.") These sites generally get more advanced. They offer great info and many offer great links too.

1) . VALVE: <http://www.bottlehead.com/valve/valve.html>. Journal of Tube Talk. The back issues are a gold mine. Index of online articles: <http://www.bottlehead.com/valve/articles.html>

2) . *The Tube Cad Journal*: <http://www.tubecad.com/>. Journal of Tube Talk. The back issues are a gold mine. Order the Software too. Index of online articles: <http://www.tubecad.com/page4.html>

3) . *Steve Bench*: <http://members.aol.com/sbench101>. All sorts of tube and electronics theory. Does he have a staff or what...? Whew! Thanks Steve.

*) *Andrea Ciuffoli's AudioDesignGuide*. A few dead links here but still a load of info. <http://www.audiodesignguide.com/index.html>

*) *Frank Philipse's site*: <http://home.wxs.nl/~frank.philipse/frank/frank.html>. Info. on European valves. Links.

*) *Audio Bizarro*: <http://spiritone.com/~tube/>. DIY projects. Links

*) *Bas Horneman's home page*. <http://home.zonnet.nl/horneman/>. Great links at "main links" section. Check out "SWcad" for schematic drawing software.

*) *Tim Reese*: <http://www.nmr.mgh.harvard.edu/~reese/>. Home of the R 10 Tube Manual cited below and check out the "Joelist" archives.

*) *Tube Diy Paradiso*: <http://www.diyparadiso.com/index1.htm>

*) *Richard Sears Audio*: http://richard984.tripod.com/vacuum_tube_audio.htm. Projects, papers, and audio literature. He designs for the Sophia line of tube amps.

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- *) *Triode Guild*: <http://www.meta-gizmo.com/Tri/index-1.html>: Stop in, check up on your thermionic coolosity, and smoke a paradox or two.
- *) *The Ultra-Fi Web Ring*: <http://p.webring.com/hub?sid=&ring=ultrafi&id=&list>
- *) *Sakuma Amplifiers*: <http://www10.big.or.jp/~dh/>.
- *) *AVVTClub* (Alesa Vaic): <http://www.elektrone.nroehren.de/avvt/indexf.htm>
- *) *Japan Audio Tubes*: <http://www.fortunecity.com/tinpan/nevermind/720/>
- *) *Foreign Language Sites*: Alta Vista translator is here: <http://babel.altavista.com/tr>
Example foreign language (German) site. <http://www.ndh.net/home/kboehm/kt88.htm>
(Home site of above German site <http://www.ndh.net/home/kboehm/proj-ind.htm>)
Simply go the Alta Vista translator and copy and paste the foreign language URL of the page you want to read to the "Translate a Web page" address block. Click German to English and translate. The translations are often poor but can still be helpful.

IV. Tube Audio Articles:

A. Collections: Sites having a collection of fine articles by various authors. I've questioned how best to present these. For now, just spend a few minutes at each site and see what is there for yourself. I might create an index at a later date.

- .) Aiken Amps (Randall Aiken): A collection of 19 articles by various authors. http://www.aikenamps.com/TI_Other.htm. Excellent!
- *) Cheever, Daniel H. *Ten Great Articles* including Dan's thesis. <http://web.mit.edu/cheever/www/main.htm>
- *) One Electron (John Atwood): A large collection of great vintage articles. http://www.one-electron.com/Misc_Docs.html#end
- .) Radau5, *The Basics of Vacuum Tubes*. A collection of articles from the 1950-60s. Approximately 14 books. http://www.radau5.ch/basics_1.html
- *) Svetlana, *Technical Bulletins*: <http://www.svetlana.com/docs/TechBulletins/TB.html>
About 60 articles covering audio, radio and guitar amp electronics. Authors include Steve Bench, Harvey Rosenberg, Jukka Tolonen
- *) SoundPractices 1999 Yearbook (@SouthernElectric Site), 13 Articles: <http://www.southernelectricaudio.com/library.html>
- *) Ken Gilbert's *Article Page*: <http://ken-gilbert.com/technical.html> a collection of notes, articles and insightful writing.
- *) D.T.N. Williamson, 5 articles by the famous amp maker. From Wireless World magazine (1947-49): <http://www.dc-daylight.ltd.uk/Valve-Audio-Interest/Articles-for-the-web/Articles-for-the-web.html>
- *) Pearl Archive: a handful of articles by Crowhurst, Edgar M. Villchur, Mannie Horowitz, Julias Postel, K.R. Sturley and R.F. Scott. Includes some nice articles on basic Push-Pull Circuit Theory : http://www.pearl-hifi.com/06_Lit_Archive/PEARL_Arch/Vol_1_Sec_1.html

B. Single articles/authors

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- *) Cheever, Daniel H., *A New Method for Audio Frequency Power and Testing Based On Psychoacoustic Data*. http://web.mit.edu/cheever/www/cheever_thesis.pdf
- *) Collum, Martin, *A Future Without Feedback*:
<http://web.mit.edu/cheever/www/colloms.htm>
- *) Crowhurst, Norman, *Some Defects in Amplifier Performance not covered by Standard Specifications*: <http://web.mit.edu/cheever/www/crow1.htm>. For more from Crowhurst please see Section II.
- *) de Lima, Eduardo; *Audio Pieces*, includes articles *Why Single Ended Tube Amplifiers? and SE Amplifier OP Impedance*: <http://usuarios.uninet.com.br/~edelima/index.htm>
- *) Hamm, Russell O.; *Tubes vs. Transistors, Is There An Audible Difference?*
<http://www.gprime.com/proaudio/tubes/tubes.htm>
- *) Hafler, David and Keroes, Robert; *An Ultra Linear Amplifier*:
<http://www.aikenamps.com/UL.pdf>
- *) Johnston, Ivan L., *Second Order Harmonic Distortion Cancellation in SE Amplifiers. Is it a Sound Practice?* <http://www.southernelectrictubeaudio.com/images/harmonic.pdf>
- *) Jung, Walter G. and Marsh, Richard; *Picking Capacitors*:
<http://www.capacitors.com/pickcap/pickcap.htm>
- *) Kimmel, Allen; *Mu Stage Philosophy*: <http://laplaza.org/~fvuotto/mustage.html>
- *) Loesch, Thorsten; *Some Thoughts About Single Ended Valve Amplifiers*.
<http://thunderstoneaudio.nav.to> (scroll down page)
- *) Mitchell, Robert M.; *Effect of the Cathode Capacitor on PP Output Stage*:
<http://www.aikenamps.com/cathcap.pdf>
- *) Olson, Lynn; *THD Spectra and the Sound of Electronics*: <http://www.aloha-audio.com/library/FindingCG.html>, *Western Electric- Rosetta Stone for Triodes*:
http://www.aloha-audio.com/library/Rosetta_Stone.html.
Read the whole “Library”, which is the last entry here, <http://www.aloha-audio.com/Library/index.html>, while you are at it.
- *) Sakuma, Susumu, *Direct Heating with The Sakuma System*.
<http://www10.big.or.jp/~dh/sp/index.html>
- *) Tolonen, Jukka; *Soft Start For Power Tubes*.
<http://www.megabaud.fi/~jtolonen/ga/amptimer/amptimer.html>
- *) Tomcik, D.J.; *The Missing Link in Speaker Operation, Amplifier Damping and Speaker Performance*. <http://www.otlamp.com/articles/tomcik/index.html>

V. Old Tube Manuals/Books: Old but not forgotten.

- 1) *Sylvania Tube Manuals* (1943,49 and 1959)
<http://www.montagar.com/~patj/electro.htm>
- 2) . *RCA Radiotron Tube Manual, No. R-10* (Tim Reese’s site)
<http://www.nmr.mgh.harvard.edu/~reese/RC10/>
- 3) *RCA HB-3 Tube Manual* (Pete Millett’s site) http://www.pmillett.addr.com/hb-3_tube_manual.htm
- 4) *Karl R. Spangenberg, On Vacuum Tubes*. (Ken Gilbert’ site) Used by grad students at Stanford studying vacuum tube design in the 40s. <http://ken-gilbert.com/spang/spangenberg.html>

OnlineTubeAudioResourceGuideOnlineTubeAudioResourceGuide OnlineTubeAudio

VI. Tube Numbering and Data, Amp Schematics and Manuals, Glossaries/Dictionaries.

Vintage Tube Manuals

* A.G Tannenbaum: need a service manual for an old amp?

<http://www.agtannenbaum.com/>

Tube Numbering explained:

*) Tube Numbering Systems (Frank's site)

<http://home.wxs.nl/~frank.philipse/frank/tubnum.html>

*) Philip, Valvo & Mullard Valve Coding:

<http://www.cs.helsinki.fi/u/oheinone/valves/pvm-coding.html>

*) Tube Numbering (MachMat's Site) : <http://www.machmat.com/info/index.htm>

*) Russian encoding system: <http://www.arrakis.es/~igapop/russianotes.htm>

*) Coding systems: <http://www.arrakis.es/~igapop/referenc.htm>

Tube data:

1) .Duncan Amps: <http://www.duncanamps.co.uk/cgi-bin/tdsl3.exe/searchform>

2) Frank's Tube Data Page <http://frank.nostalgiaair.org/index.html>

3) Triode Electronics Tube Data Sheets: www.triodeel.com/tubedata.htm

4) Radau5's tube data sheets: <http://www.radau5.ch/valves.html>

5) Tubebuilder Tube Data: <http://www.tubebuilder.com/tubedata.html>

6) Vacuum Tube Valley: <http://www.vacuumtube.com/FAQ.htm>

7) Svetlana, Tube Dictionary: <http://www.svetlana.com/docs/dictionary.html>

8) Audiomatica, Tube Directory: <http://www.mclink.it/com/audiomatica/tubes/home.htm>

9) National Valve Museum's list of Equivalents: <http://www.valve-museum.org/>

10) 4Tubes. <http://www.4tubes.com>

11) Tube Collector's Association: <http://www.tubecollectors.org/>

12) Mach-Mat: <http://www.machmat.com/sheet/index.htm>

13) Kytelabs Tube infobase: <http://www.qsl.net/dl7avf/roehren/roehren.html#TOC>

14) An Intro to NOS tubes: <http://www.soundstage.com/tubeor/tube.htm>

15) Western Electric Archives:

http://www.westernelectric.com/spec_sheets/we_spec_sheets.htm

16) Tom Jennings: <http://www.wps.com/archives/tube-datasheets/index.html>

17) Åke's TubeData: <http://www.tubedata.com/>

18) Magic Sound of Tubes (NOS): great pictures of NOS tubes.

<http://spazioinwind.libero.it/themagicsound/index.htm>

19) Bill's (NJ7P) Database: <http://hereford.ampr.org/cgi-bin/tube?index=1>

Schematics:

* Pat's Schematics: One of the largest collections online.

<http://nanaimo.ark.com/~pat/index.htm>

* Dynaco Schematics: <http://www.geocities.com/vintageaudio/>

* Mach Mat: <http://www.machmat.com/schema/index.htm>

* One Electron: http://www.one-electron.com/FC_Consumer.html

* Circuit Archive (Dynaco and Heath) <http://www.circuitarchive.co.uk/>

Any fool can ask more questions than seven sages can answer.

OnlineTubeAudioResourceGuideOnlineTubeAudioResourceGuide

OnlineTubeAudio

*** Dr. Tube: <http://www.drtube.com/audioamp.htm>

*** Tubebuilder: <http://www.tubebuilder.com/schematic2.html>

*** Cuno's Triode Page: a nice collection of 300b schematics:
<http://www.triode.club.tip.nl/>

*** Allen Wright, Vacuum State: <http://www.vacuumstate.com/schematics.htm>

Dictionaries/Glossaries:

* Tube Cad Journal Audio Glossary: <http://www.tubecad.com/glossary/index.html>

* RCA 1939 Reference Book: <http://www.nostalgiaair.org/nostalgiaair/glossary/index.asp>

* Rane Pro Audio Reference: <http://www.rane.com/digi-dic.html>

* Audioed, Audio Glossary: http://www.audioed.com.au/glossary_free1.html

* DIY Audio Corner: <http://www.nightstormer.com/def.htm>

* Potentiometer glossary: <http://www.potentiometer.com/glossary.asp>

. Randall Aiken, *A Glossary of Common Amplifier Terms*,
<http://www.aikenamps.com/AmpTerms.html>

VII. Forums: Places to ask questions.

*) Bottlehead: <http://www.audioasylum.com/forums/bottlehead/bbs.html>

*) Audio Asylum: <http://www.audioasylum.com/forums/tubediy/bbs.html>

*) Dr. John's Cheap Tube Audio:
http://groups.yahoo.com/group/doctorjohn_cheaptubeaudio/

*) James Melhuish's Single Driver Forum: <http://f18.parsimony.net/forum31999>

*) DIYAudio: <http://www.diyaudio.com>

*) Harmonic Discord: <http://www.harmonicdiscord.com/forums/>: includes forums of about 30 different manufacturers.

*) rec.audio.Tubes: <http://groups.google.com/groups?hl=en&lr=&ie=UTF-8&group=rec.audio.tubes>

*) DutchForce: <http://www.dutchforce.com/~eforum/index.php>

*) Decware: <http://www.decware.com/cgi-bin/yabb/YaBB.cgi>

*) Art DIO Mod: <http://groups.yahoo.com/group/DIOmods/messages>

*) Google sci.electronics forum: <http://groups.google.com/groups?hl=en&lr=&ie=UTF-8&group=sci.electronics>

*) Thunderstone Audiophile and Technical
http://groups.yahoo.com/group/Thunderstone_audiophile/?yguid=106066265
http://groups.yahoo.com/group/Thunderstone_technical/messages/119

VIII. Journals

.) VALVE: (Online) <http://www.bottlehead.com/valve/valve.html>

Previous Volume Index: <http://www.bottlehead.com/valve/cdindex.html>

.) The Tube Cad Journal: (Online) <http://www.tubecad.com/>

Previous Volume Index: <http://www.tubecad.com/page4.html>

3) Positive Feedback (Online) <http://www.positive-feedback.com/Issue1/issuetoc.htm>

4) AudioXpress: (Print only) <http://www.audioXpress.com> Back issues of Audio Electronics, Glass Audio & Speaker Builder magazines too.

Any fool can ask more questions than seven sages can answer.

OnlineTubeAudioResourceGuideOnlineTubeAudioResourceGuide OnlineTubeAudio

- 5) *Vacuum Tube Valley* (VTV): (Print only). <http://www.vacuumtube.com/>
- 6) *Tube Collector*: <http://www.tubecollectors.org/>. (Print Only) Check the back issues for tube lore!
- 7) *Sound Practices*: (Print only). Now defunct, Previous Volume Index here: <http://www.southernelectricaudio.com/backidx.html>. (Southern Electric)

IX. Vintage

- * *One Electron Site*, Collection of old articles from *Radio News*, *Electronics Magazine*, and others. http://www.one-electron.com/Misc_Docs.html#end
- * *Radio Era Archives*: <http://www.radioera.com/>. Billed as the largest site for vintage radio.
- * *FireBottles Audio*: Great collection of info on Dynas, Eico, Fisher etc. <http://intra.engr.uark.edu/~lar/fireamps.html>
- * *Jim Mc Shane's Citation page*: <http://pages.prodigy.net/jimmcshane/>
- * *Unofficial Dynaco Home Page*: <http://home.indy.net/~gregdunn/dynaco/index.html>
- * *H.H. Scott Hi-Fi Stereo Archive*: <http://hhscott.com>
- * *The National Valve Museum*, <http://www.valve-museum.org/>. The “articles”, “exhibits” and equivalents” sections are all great.

X. Good Folks who Sell Stuff. Worth perusing even if you ain't buying. Some of these commercial sites have loads of info.

A. General: These folks sell it all.

- *) *Triode Electronics*: Read Uncle Ned's “Mailbag” and “Dusty files.” <http://www.triodeel.com/tlinks.htm#triode>
- *) *Southern Electric*: Audio Books, supplies and past issues of the late *Sound Practices Magazine*: <http://www.southernelectricaudio.com/index.html>
- *) *Old Colony/AudioXpress*: Audio Books, back issues of *Glass Audio*, *Audio Craft*, much more... <http://www.audioxpress.com/>
- *) *Vacuum Tube Valley*: <http://www.vacuumtube.com/>
- *) *Antique Electronic Supply*: <http://www.tubesandmore.com/>
- *) *Angela Instruments*: Don't miss the “how to” section. <http://www.angela.com/>
- *) *Handmade Electronics*: <http://www.hndme.com/first.html>
- *) *Mouser*: <http://www.mouser.com/>
- *) *Parts-Express*: <http://www.parts-express.com/>

B. Tubes

- * *Tube World*: Tubes in the U.S.: <http://www.tubeworld.com/>
- * *Jan Wüsten's site*: <http://www.die-wuestens.de/engindex.htm> Great source of Euro tubes and other info.
- * *Tubes.ru*: Great source for Russian tubes. Data too: <http://www.tubes.ru/>
- * *Vintage Tube Service*: <http://vintagetubeservices.com/> Check out the nice short history of tube companies.

C. Specialty DIY Suppliers

Any fool can ask more questions than seven sages can answer.

OnlineTubeAudioResourceGuideOnlineTubeAudioResourceGuide

OnlineTubeAudio

***Thlaudio: <http://www.thlaudio.com/indexE.htm>

***Cree, Schottky diodes and stuff(soon):

<http://www.cree.com/products/power/index.htm>

*** Tubebuilder: <http://www.tubebuilder.com/>

*** Front Panel Express: need help laying out or cutting a front -plate?

<http://www.frontpanelexpress.com/home/index.htm>

* Quality Sound Supply (Jean Pierre Magnan) : quality chassis

<http://cf.geocities.com/qltysnd/pages/frameset.html>

* EIFL, Imports from Japan: Tango and Tamura trannies, Sun Audio, Denon Cartridges, etc.. <http://www.eifl.co.jp/index/export/export2.htm>

* OnLine Metals: Top Plates, pads, switches. etc: <http://www.onlinemetals.com/>

* Shallco: <http://www.shallco.com> Good source of high-quality attenuators.

* Electronic Concepts, <http://www.eci-capacitors.com/> std. and custom capacitors

* SupraVox, <http://www.supravox.fr/> new production full-range field coils

* Fertin, <http://perso.wanadoo.fr/hpfertin/>

* Audio Consulting : <http://www.audio-consulting.ch/index.html>. Inductive grid stoppers anyone, custom chassis?

* Michael Percy Audio: <http://www.percyaudio.com/>

* Electra Print: Custom and stock iron: <http://www.execpc.com/~n9zes/electra.html>

* Vintage Audio Traders Homepage: <http://community-2.webtv.net/KerrB/VINTAGETUBEAMPHORN/index.html>

* Reliable Capacitors: <http://www.capacitors.com/index.html>

* Diy Paradiso: Check out the designs info too. <http://www.diyparadiso.com/index1.htm>

* MagneQuest, Iron - air-gapped and parallel feed transformers, chokes:

<http://www.magnequest.com/>

* Gootee : Used Test Equipment(Scopes etc):

<http://www.fullnet.com/u/tomg/gooteesu.htm>

D. Kits (under construction)

* Bottlehead

* Consonance, DIY Cable

* SAS

* Welborne

* Dackit <http://home.triad.rr.com/scottnixon/dac.htm>

E. Hi End Systems . Dream on.....

* My Friend's Systems: <http://www.arduman.com/aa/Sayfalar/friends.htm>

* Audio Club of Athens: <http://www.aca.gr/>. Check out the "High end Systems link:"

* Gilles Molinier horns: <http://www3.sympatico.ca/rsf/France.htm>

XI. Megalink Sites: Sites containing large collections of links and/or information.

1) ePanorama: <http://www.epanorama.net/index.php?index=info>

A huge "panorama" of electronics available on the web.

2) Steve Ekbald's Audio Related Sites: An amazingly large collection of audio links.

<http://www.wssh.net/~wattsup/arsl.html>

Any fool can ask more questions than seven sages can answer.

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3) *World Tube Audio Portal*: Billed as the largest tube audio site on the web.

<http://www.worldtubeaudio.com/>

4) *Martindale's Calculators On-line Center*: <http://www-sci.lib.uci.edu/HSG/RefCalculators.html>. Huge collection of calculators. Good stuff under heading of "Music", "Engineering" (acoustics and audio), and "Hi-fi sound systems."

5) *Audio Valve's Link Page*: <http://www.cs.helsinki.fi/u/oheinone/valves/>

6) *Audio Scientific Calculator page*:

<http://www.audioscientific.com/Auto%20Calculators%20&%20References%20Links.htm>

7) *Steve Ekblad's Software/Calculator page*: <http://www.wssh.net/~wattsup/audio/>

8) *Spice Links Resources*: <http://www.penzar.com/links.htm>

XII. Solid State (gasp) sites: The following sites cover audio electronics. Not tube folk, but very valuable.

*) *Doug Self, The Self Site*: <http://www.dself.demon.co.uk/index.htm>

*) *Rod Elliot, Elliot Sound Products*: <http://sound.westhost.com/index.html>

*) *Class A Amplifier Site*. By Geoff Moss: <http://www.gmweb.btinternet.co.uk/>

Dedicated to the circuits of John Lindsey Hood.

XIII. Software downloads and Calculators

1) *X Circuit*: Draw your own circuit schematics. Available at the bottom of this page:

<http://www.ibiblio.org/obp/electricCircuits/>

2) *Spice*: Spice is a public domain program used to simulate analog circuits. There are many versions of this program and some are more suitable for use with tube circuits than others. Like all aspects of tube audio folks have different opinions of computer simulation. Norman Koren believes it will be invaluable. Others, like Kevin O' Connor, believe tubes vary too much to really model well. Perhaps the art is knowing the limits of the model used. Anyway, the Duncan site has great information about PSpice for tube circuits. <http://www.duncanamps.com/spicevalvesgt.html>

Spice "Lite" is available free from Beigebag (John Broskie of TCJ works their now), <http://www.beigebag.com>, and they offer other versions for 30-day trials. See *LEC*, Vol. V (above in Section II.), for more on using Spice. Spice simulations are used and presented throughout the *LEC* material.

3) *Norman Koren's Spice Tube Model Page*:

<http://www.normankoren.com/Audio/index.html>

3.5) Links to Online Spice Resources: <http://www.penzar.com/links.htm>

3.6) Pspice.com <http://www.pspice.com/models/default.asp> includes a PSpice user forum.

3.7) eCircuit Center Spice Basics: <http://www.ecircuitcenter.com/Basics.htm>

3.8) Cadence, Pspice 9.1 student version free download:

<http://www.cadencepcb.com/products/downloads/PSpicestudent/default.asp>

4) *Duncan Amps* has several other nice programs available including a nice power supply calculator that is used by Randall Aiken, Jim De Kort and others:

<http://www.duncanamps.com/software.html>

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- 5) *McSquared Site*: <http://www.mcsquared.com/java.htm>. Calculators for Decibels, wavelength, room modes, Ohm's law, Speaker Q.
- 6) *Jim DeKort*: See what Jim uses for tube calculations, plate-choke rolloffs and Power supply issues. Located in "DIY section" under "Tips and Tricks": <http://www.vt52.com/>
- 7) *Glassware Audio Design* (Tube Cad Journal): http://www.glassware.com/Audio_Software_Descriptions.html
http://www.tubecad.com/articles_2001/Tube-Based_Crossovers/page7.html.
- 8) *Steve Ekblad's* Calculator page: a large collection.
<http://www.wssh.net/~wattsup/audio/>
- 9) *Linear Technologies*: <http://www.linear-tech.com/software/>: Spice and schematic software.

XIV. Books: Writers have different perspectives and communication styles. If you are like me it helps to have a couple different people tell you the same thing in a little different way. I've limited this section to books I have found helpful.

A. Basic/Intros to Electricity

- 1) Bureau of Navy Personnel, *Basic Electricity*. An introduction to electricity
- 2) Bureau of Navy Personnel, *Basic Electronics*. Clearly written introduction to electronics. Unlike most modern electronics books this book talks about tubes. Kind of a "sleeper." Recommended.
- 3) Van Valkenburgh, Nooger & Neville: *Basic Electricity*. If your electrical background is limited to putting batteries in flashlights this is the book for you. Kidding aside, a very good book for starting out.
- 4) Horowitz and Hill, *The Art of Electronics*. A very good and often-recommended book by experienced folk (Note: the words "tube" and "valve" do not appear in its index). IMHO "Basic Electronics" (above) is a better intro for beginners interested in tube diy. (Please no condescending emails from the EEs). Get a copy for \$15 here:
<http://www.oscarindia.com/cgi-bin/store/merchant.cgi>
- 5) Owen Bishop, *Understand Electronic Filters*. A very good book. Filters are everywhere. This book lets you understand them. Highly recommended by John Broskie at TCJ.
- 6) Rozenblit, Bruce: *Audio Reality*
- 7) . Any Pre 1960 (thereabouts) *ARRL (American Radio Relay League) Handbook*. Excellent overview. Available on E-bay for < \$20.
- 8) Army Technical Manuals (1951-52). These are all very good if you are beginning. Often available on E-bay for bargain prices. The Manual on Electron Tubes is highly recommended and TM11-681 has a very clearly written appendix on the use of trigonometry for ac/phase theory. TM11-663, Electronic Power Supplies; TM11-661, Electrical Fundamentals(dc); TM11-681 Electrical Fundamentals (ac); TM11-662, Basic Theory and Application of Electron Tubes.

B. Tube Amplifiers All of the books below offer much more than one needs to DIY an audio amp. If you want to know what is what, why, and turn tube electronics into a

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hobby they are all good. Many of the modern books do NOT offer a lot on SETS. All require some knowledge of basic electricity (see above).

- 1) Jones, Morgan: *Valve Amplifiers*. Good for all levels. Includes a nice introductory chapter that, while maybe to condensed (Jones calls it “ruthlessly pruned”) for a beginner to learn from, presents a nice outline of the basic mathematics and formulas used in tube audio electronics. Well organized. Jones is not a SE-DHT type.
- 2) Rozenblit, Bruce: *A Beginner’s Guide to Tube Audio Design*. An interesting book. Very loosely organized in some ways. “Basics” are sprinkled throughout and only 80 pages of actual text. But Rozenblit handles some topics very well and every page is worth rereading for one reason or another. Rozenblit is not an SE-DHT guy either.
- 3) O’Connor, Kevin: *Principles of Power*. O’Connor is another guitar amp guy (Aiken is the other) who writes clearly and simplifies things in a helpful way. Good book. Kevin is not a SE-DHT guy either.
- 4.) F. Langford Smith, *Radiotron Designer’s Handbook*, 3rd. There are differing opinions as to which edition is better. Earlier being simpler for beginners and the later more complete. Good for SETS.

XV. Acoustics and Sound: it takes more than an amp to make it sound good.

- 1) *Acoustics and Vibration Animations* by Dan Russell of Kettering University:
<http://www.kettering.edu/~drussell/Demos.html>
- 2) *The Physics Classroom*:
<http://www.glenbrook.k12.il.us/gbssci/phys/Class/sound/soundtoc.html>
- 3) *Art Ludwig’s Sound Page*: <http://www.silcom.com/~aludwig/>
- 4) *Anstendig Institute*: <http://www.anstendig.org/>

XVI. MISC. Speakers/Vinyl (under construction)

- * *Audio Invest*, free support and information site for the brands Luxman and Fidelity Research, including Thorens, Dual and dbx. <http://www.audioinvest.no/index2.htm>
- * *The Technology of ESLs*, James Strickland: <http://www.izzy-wizzy.com/audio/acoustat.pdf>
- * *VinylEngine*: Articles, tone arm and cartridge manuals and other LP stuff...
<http://www.nakedresource.com/articles.shtml>
- * *Martin King’s Site for Quarter Wavelength Loudspeaker Design*: <http://www.quarter-wave.com/>

XVII. A few Articles by Topic: These articles tend to be more DIY/hands-on oriented than the articles listed in Section IV. Not always though. **Please e-mail me with suggestions to add to the list.** Craig wryder@chartermi.net

A . indicates a recommended Intro article (under construction).

Bias and Biasing

Any fool can ask more questions than seven sages can answer.

OnlineTubeAudioResourceGuideOnlineTubeAudioResourceGuide OnlineTubeAudio

- * “Lord Valve”, *How to Bias Your Amp*: <http://duncanamps.com/technical/lvbias.html>
- * Gabe Velez, *Biasing*: <http://members.tripod.com/~gabevee/biasing.html>
- * Aikens, *Designing Common Cathode Amps*:
www.aikenamps.com/CommonCathode.htm
- * NEETS, *An Intro. to Grid Biasing*: <http://www.tpub.com/neets/book6/20f.htm>
- * Army Manual, *Amp Fundamentals*: <http://www.aikenamps.com/ampfund.pdf>.
- * Randall Aiken, *What is Biasing*: <http://www.aikenamps.com/WhatIsBiasing.htm>
- * Herbert Ravenswood, *The Fixed Bias Story, Is fixed Biasing Really Better?*
<http://www.southernelectrcaudio.com/images/fixbias.pdf>

Capacitors/Capacitance

- *** CapSite 2002, Introduction to Capacitors: <http://my.execpc.com/~endlr/index.html>
- *** K.A. Weber, *On Capacitor's Dielectric Materials, a Chemist's View*:
http://www.audience-av.com/on_capacitor_dielectric_material.htm
- * R. Aiken, *Miller Capacitance*: <http://www.aikenamps.com/MillerCapacitance.html>
- * L.Olson, *Building a better Capacitor*: <http://www.aloha-audio.com/library/capacitor.html>
- * Young & Marsh, *Picking Capacitors*: <http://www.capacitors.com/pickcap/pickcap.htm>
- * Gabe Velez, *Using Capacitors*: <http://members.tripod.com/~gabevee/capacitor.html>
- * Steve Bench, *The Sound of Capacitors*: <http://members.aol.com/sbench102/caps.html>
- * William Beaty, *How Capacitors work*, <http://www.amasci.com/emotor/cap1.html>
- * Kevin Ross : *Basic Circuits, Bypass Capacitors*:
<http://www.seattlerobotics.org/encoder/jun97/basics.html>
- * Richard Marsh, *Considerations For a High Performance Capacitor*
<http://www.capacitors.com/consider/consider.htm>
- * Richard Marsh, *Phase Response vs. ESR*: <http://www.capacitors.com/multicap/phase-esr/phase-esr.html>
- * Capacitor *Formulas*: <http://www.illinoiscapacitor.com/Formulas.asp>
- * Capacitor *Glossary*: <http://www.illinoiscapacitor.com/Glossary.asp>
- * *An Introduction to the Application of capacitors*:
<http://www.illinoiscapacitor.com/pdf/papers/Applications.pdf>
- * *An Introduction to Film Capacitors*:
http://www.illinoiscapacitor.com/pdf/papers/Intro_To_Film_Capacitors.pdf
- * *Replacing Capacitors in Old Radios*. (from Phil's Old Radios Site) A nice practical intro for some stuff but it fails to tell you make sure you discharge the caps first!
<http://antiqueradio.org/recap.htm>

Circuit Design/Considerations

- * Jim DeKort, *Choke vs. Resistive Loads*:
http://www.vt52.com/diy/tips/tips_chokeload.htm
- * Steve Bench, *Of Load Lines, Power Output and Distortion*.
<http://members.aol.com/sbench102/po-dis.html>
- * Randall Aiken, *Designing Common Cathode Amps*:
www.aikenamps.com/CommonCathode.htm

Any fool can ask more questions than seven sages can answer.

Filters

- * ** *Basics of Filter Design*: <http://www.electronics-tutorials.com/filters/filters.htm>
- * NEETS, *Primer on PS Filters*: <http://www.tpub.com/neets/book6/22d.htm>
- * Ethan Winer, *Audio Filter for Beginners*: <http://www.ethanwiner.com/filters.html>
- * Tony Kuphaldt, *Lessons in Electric Circuits* (Vol.II, Chapter 8)
http://www.ibiblio.org/obp/electricCircuits/AC/AC_8.html
- * University St. Andrews Guide, *Filters and Frequency*: http://www.st-and.ac.uk/~www_pa/Scots_Guide/audio/part3/page1.html

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