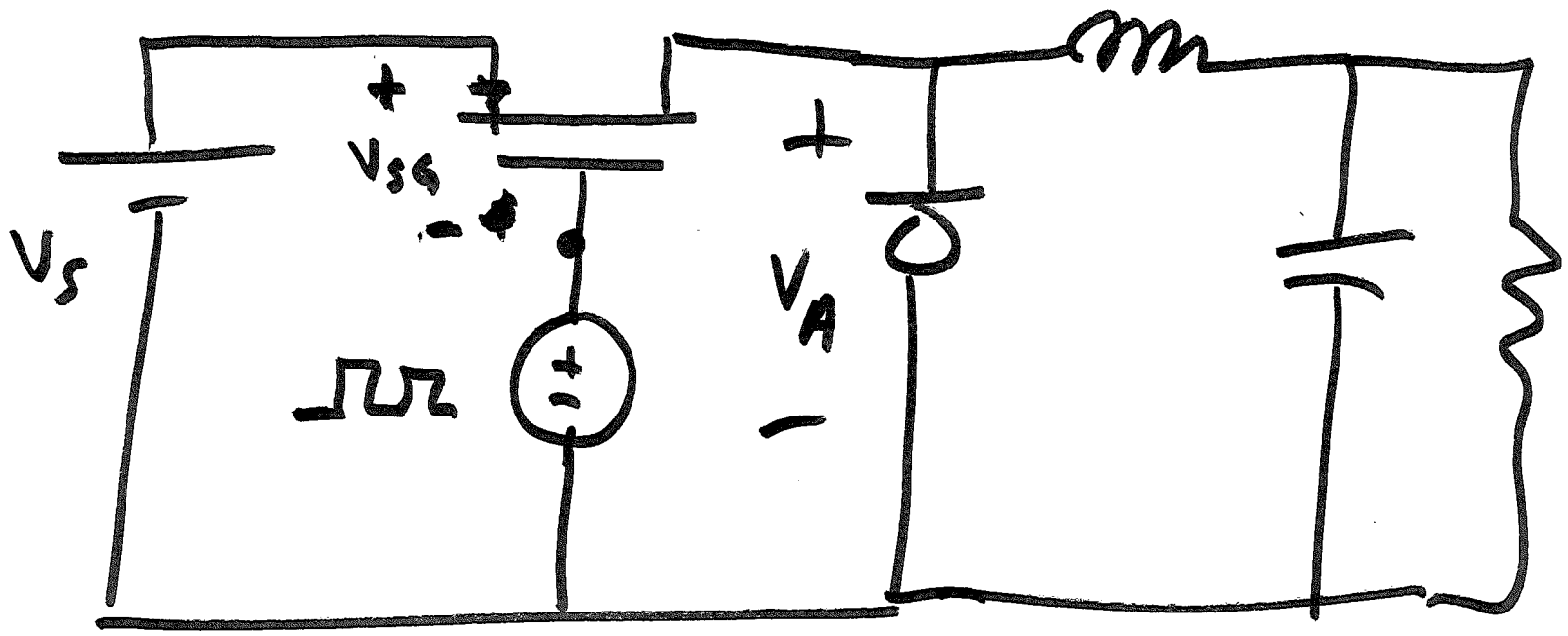
ECE 404-TD / 504-TD

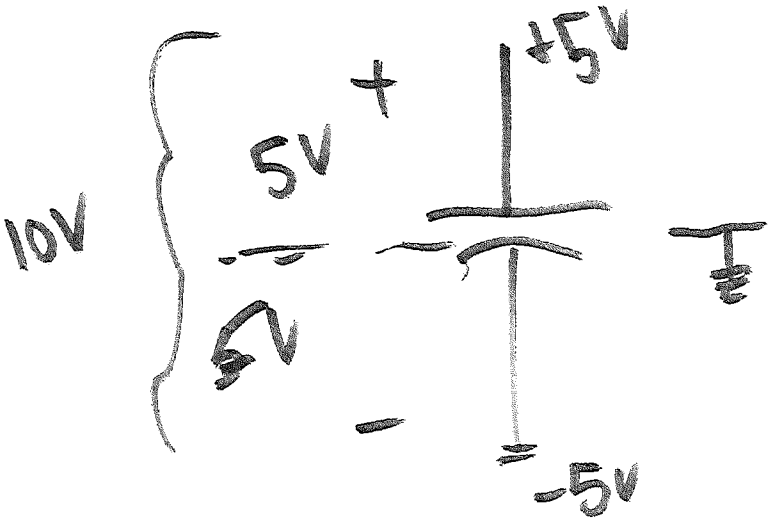
ST: T&D APPLICATIONS OF VOLTAGE SOURCE CONVERTERS

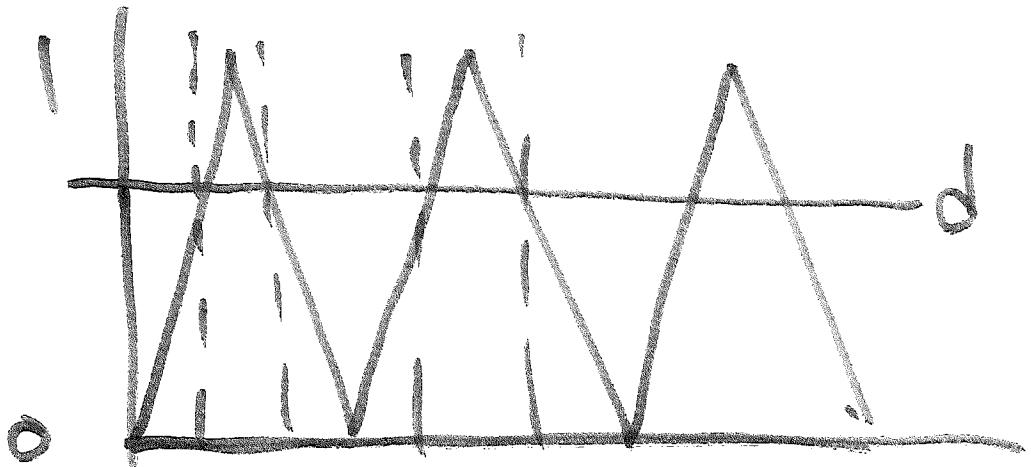
SESSION no. 5

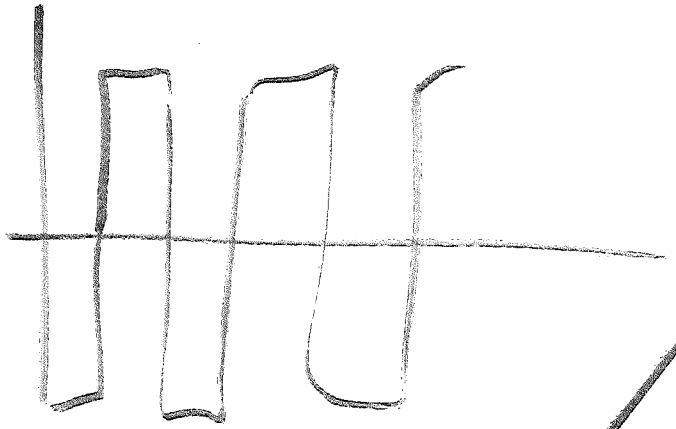


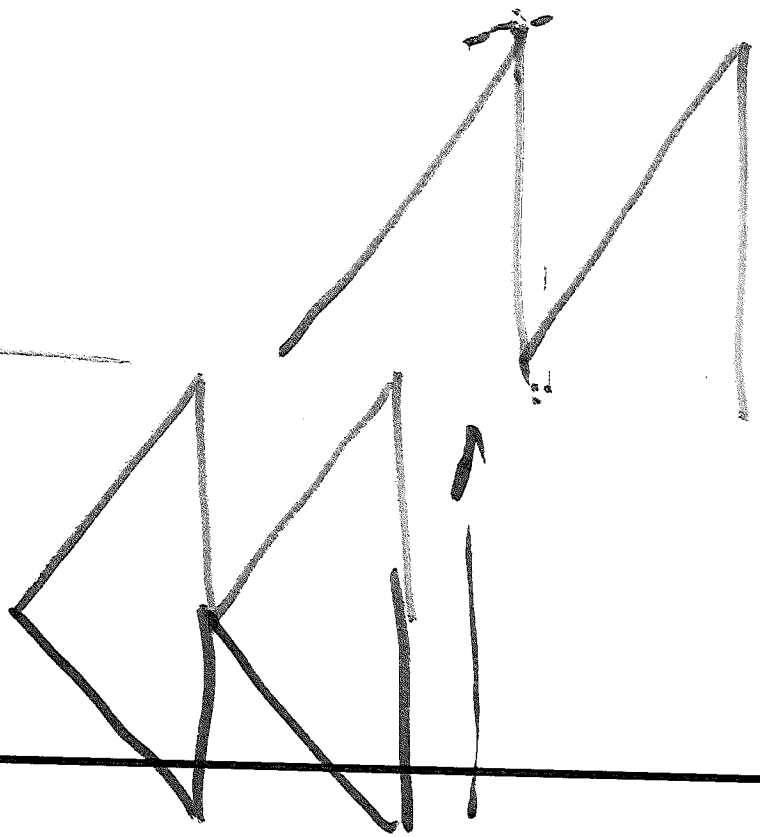
$V_{SG} = 0$ BLOCKS

$V_{SG} = V_S \geq 2.2V$ CONDUCT


10V
5V
5V
+
+5V
-
-5V


d
0





Getting ATP:

- Available in ECE dept labs on campus
- Request a license through http://www.emtp.org free
  - » Once you have confirmation they will send you instructions for downloading from a secure server
  - » Or, once verified, I can give you access to a zip file with relevant files

C:\Tools\prog\

Installing ATP:

- Minimum to Download
  - » Mingw version of ATP
  - » ATPDraw -- latest version or latest patch
    - – Presently Atpdraw57.zip
  - » PlotXY
- Option: ATP Easy Installer
  - » Download from secure sites in Japan

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Installing ATPDraw

- Installation is fairly easy
- Default installation path "Program Files" → avoid this
- The space in the file name can create problems running ATP from ATPDraw
  - » Install it somewhere else. I normally install in "C:\tools\prog\ATPDraw"
- Install program may create shortcut in the start menu, but not very cleanly

Running ATP from ATPDraw

- Still need a copy of ATP
- Licensed users can get other versions
- Follow installation directions for yours
- ATPDraw calls ATP from a DOS Batch file (extension *.bat)
  - » For example, I call it "RUNATP.BAT"
- Passes full path to file when calls ATP

Sample Batch File

- The following batch file is for Ming32 ATP

```
SET GNUDIR=C:\tools\prog\atp\
SET PATH=C:\tools\prog\atp;"%PATH%"
tpbig  both %1 s -r
```

The first line defines variable GNUDIR

» Different ATP versions use different name

» Sets program working environment

» The final "\" is important

Sample Batch File (cont.)

- Second line adds executable to your search path (not needed if set this at boot time)
- The next line calls ATP itself

» `tpbig both %1 s -R`

– "both" tells program to write error messages to screen and to file (useful for debugging)

– Could also set "disk" to only do disk file or leave blank for no message

– First "%1" is input data file from ATPDraw

Sample Batch File (cont.)

- The "s" is to create appropriate output file.
- "-R" tells ATP overwrite existing output file if one exists

- This bat file will let you run ATP, and all of the support program (line constants etc)

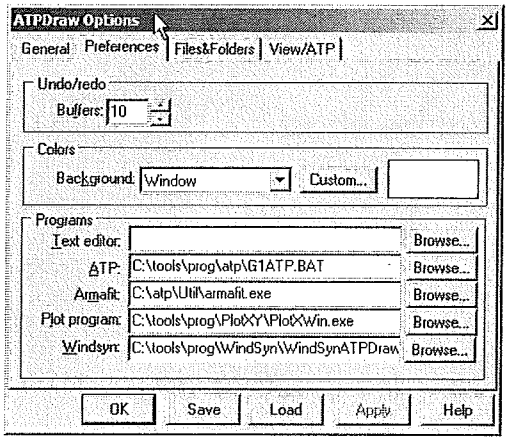
Editing "startup"

- ATP reads a file called "startup"
  - » Resides in same directory as tpbig
  - » Sets variables for the program
- A few suggested changes from default
  - » Change PL4 file format to work with PlotXY
    - NOBLAN set to 0 {ignore blank lines}
    - NEWPL4 set to 2 {won't work with Analyzer}

Setting Up ATPDraw

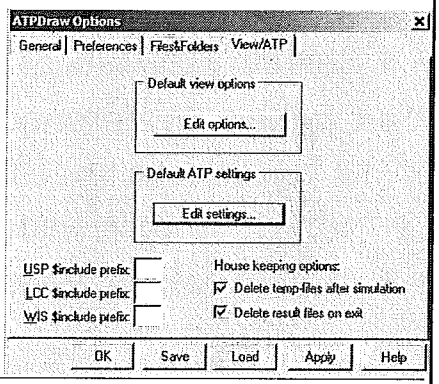
- Open up ATPDraw
- Select: "Tools" pull down menu
- Select: "Options..."
- Choose "Preferences" tab
  - » You select a text editor, or use Notepad (default)
  - » "ATP" is where you set path to your batch file
- Armafit: which we won't cover in this course

ATPDraw "Preferences"



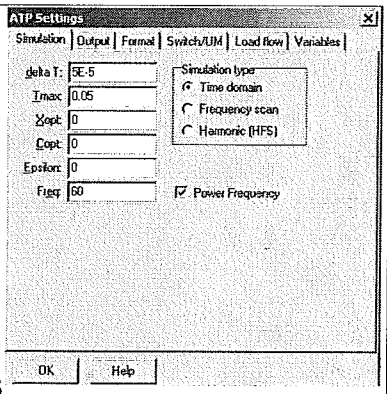
Further Settings

- The "Files&Folders" tab settings are ok
- However, you do want changes in the View/ATP tab
  - » Select "Edit settings" tab
  - » You may want to change some of the default settings. However, you can change any of these for a specific data file



Simulation Settings

- Default time step (deltaT) is very small
- Default run time short
- Xopt and Copt ok
- Select "Power Frequency"
  - » Reset to 60 Hz from 50Hz
  - » Can mess up some sources

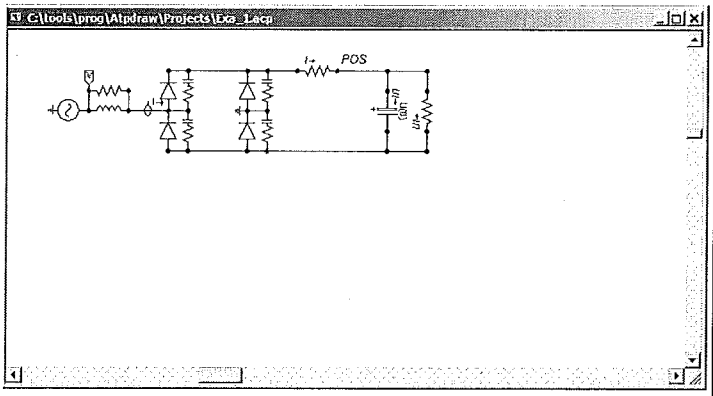


Saving New Settings

- The "Save" or "Apply" buttons aren't sufficient to permanently save change
- Also choose: Tools --> Save Options
- These are all saved into a file called ATPDraw.ini
  - » Typically saved in user's settings
  - » Could put copy in the directory with ATPDraw.exe

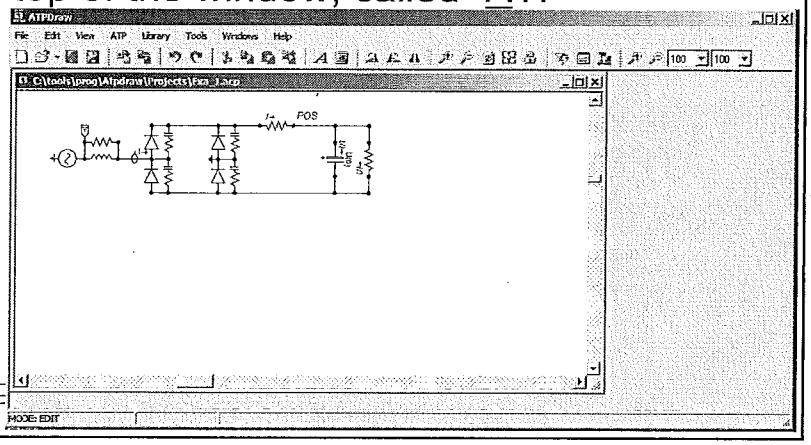
Example 1

- Try to run example case to make sure program installed and set up correctly



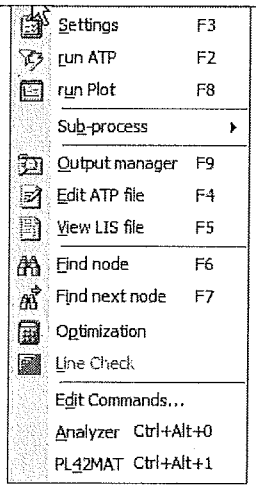
ATP Menu

- A new pulldown menu is now available at the top of the window, called "ATP"



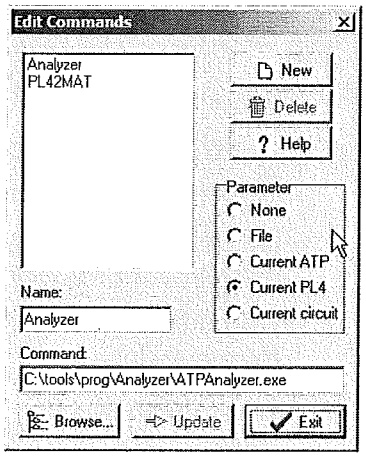
ATP Menu

- Settings is changes deltaT etc. for a given case
- "Make File As" generates ATP data file from drawing
- Run ATP calls your bat file
- Each "Edit" calls text editor
- Make Names, makes node names for drawing



Edit Commands

- Allows you to set additional commands
- Run other ATP versions
  - » On Current ATP drawing
  - » On Selected File
- Run plot programs
  - » On Current PL4
- Use "Update" to set



Saving New Settings

- The "Update" buttons isn't sufficient to save for next time
- All choose: Tools --> Save Options

Running an ATP File

- Now we run the example case opened earlier
- Always a multi-step process
  - » 1) Make file to create ATP data file from drawing.
    - – Must do this every time you change drawing
    - – Default is to place this in "ATP" subdirectory under ATPDraw home directory (with extension *.ATP)
    - – Can edit this file with "Edit ATP-File" option (not saved to drawing file)
  - » 2) Run your case
  - » 3) Call plotting program

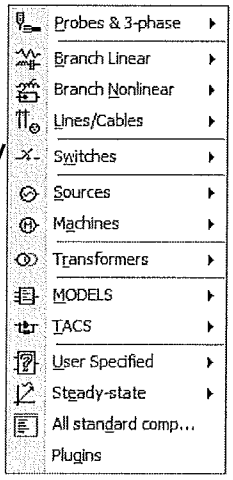
ECE 404/504
Lecture 5

Running an ATP File

- The drawing file saved separately (save often)
- Remember to save your changes often
- Default is to save this in the "Project" subdirectory under ATPDraw
- Note that if want to save elsewhere, need to select a new home for both ADP and ATP files
  - » PL4 and *.lis (or *.out depending on version) are written to same directory at *.ATP file
  - » Need to cleanup directories periodically

Making You Own File

- Open a new drawing (from File menu or from icon)
- Can get the component menu by right clicking mouse in the drawing screen
- Each item lets you select components to create
- More later….



Transient Analysis of Control Systems (TACS)

- Introduced in EMTP in 1976
- Developed to model controls for HVdc converters (Pacific Intertie)
- Model interactions between system transients and control systems
- Each variant of EMTP has it own variant
- ATP has two: TACS and Models

What TACS can do

- Model control systems
  - » Generator excitation and governor control
  - » Control loops for power electronic converters
  - » Firing circuit for power electronics
  - » Relay algorithms

What TACS can do

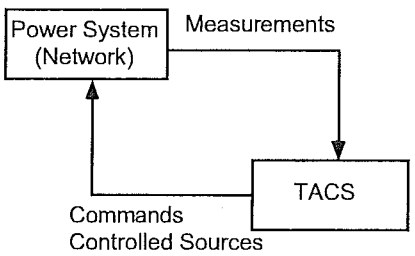
- Monitor and post-process network variables
  - » Analog and digital filters
  - » RMS voltages and currents
  - » Calculate P and Q
  - » Compute motor/generator torque or flux
  - » Reference frame transformations

What TACS can do

- Simulate mechanical/electromechanical
- Non-linear reponses
- Create models for devices without built-in models – for example, arc resistances
- Create harmonic sources
- Variable frequency sources

TACS Relationship to Network Solution

- Control system models solved separate from network
  - » Different equation formats
  - » First network then TACS in each time step
  - » Leads to on step time delay



General Format

- TACS design from point of view of reproducing Laplace domain block diagram
  - » Converted to difference equations
  - » Arbitrary connections of blocks
- Signal and variable names limited to 6 characters
- Can implement digital controls
- Some limited FORTRAN expressions

TACS and ATPDraw

- ATPDraw Interface for TACS
  - » Not as nice as circuit interface, but much improved
- Not essentially to always draw connecting lines
  - » Use the same variable names instead
  - » Will generate a warning message about duplicate names when first run ATP file
- Several of the example cases shipped with ATPDraw have TACS modelling