- unzip into

   C:\tools\prog\atp

   " " " " atpdraw

   → atpdraw.ini
## Installing ATP:

- Minimum to Download
  - Mingw version of ATP
  - ATPDraw -- latest version or latest patch
    - Presently Atpdraw62.zip
  - PlotXY
- Installation complete set is a little tricky
- Option: ATP Easy Installer
  - Download from secure sites in Japan

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## Installing ATPDraw

- Installation is fairly easy
- Avoid installation path “Program Files”
- 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”
ATPDraw "Preferences"

- 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
UI 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

Intro to ATP and ATPDraw Spring 2018

UI 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".

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
UI 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

UI 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

Making Your 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.....
When handing in homework assignments

- Include any hand calculations you did to set up the problem
- Include circuit diagram
- Include text from the *.atp file (optional)
- Include simulation plots
  - Zoom in on key results
  - Capture key numbers
  - Interpretation of the results matters!
- See examples in upcoming lectures
ECE524: Transient RC Response

Define units:

\[ \text{MW} := 1000 \text{kW} \quad \text{MVA} := \text{MW} \quad \text{MVAR} := \text{MW} \quad \text{kJ} := 1000 \text{J} \]

\[ \text{sec} := 10^{-3} \quad \text{mu} := 10^{-6} \quad \text{pu} := 1 \]

Each phase of a 3-phase capacitor bank is rated at 60 MVA at \( (3.8) \sqrt{3} \) kV. A second bank has a rating of 30 MVA at \( 13.8/\sqrt{3} \) kV. The two are to be paralleled by momentarily connecting them through a 100 ohm stainless steel resistor (one for each phase), which will be subsequently shorted out.

What will be the peak current during the switching operation?

**Analytical Solution**

Known parameters:

\[ V_{\text{ratedLL}} := 13.8 \text{kV} \]

\[ \omega := 2\pi f \]

\[ Q_{c1,1\text{phase}} := 60 \text{MVA} \]

\[ R_{\text{limiting}} := 100 \text{ohm} \]

\[ Q_{c2,1\text{phase}} := 30 \text{MVA} \]

Since the banks appear to be Y connected:

\[ X_{c1} := \frac{V_{\text{ratedLL}}^2}{3Q_{c1,1\text{phase}}} \]

\[ X_{c1} = 1.06 \Omega \]

\[ X_{c2} := \frac{V_{\text{ratedLL}}^2}{3Q_{c2,1\text{phase}}} \]

\[ X_{c2} = 2.12 \Omega \]

\[ C_1 := \frac{1}{\omega X_{c1}} \]

\[ C_1 = 2507.17 \mu \text{F} \]

\[ C_2 := \frac{1}{\omega X_{c2}} \]

\[ C_2 = 1253.58 \mu \text{F} \]

\[ V_{\text{pk}} := \sqrt{\frac{2}{3}} V_{\text{ratedLL}} \]

\[ V_{\text{pk}} = 11.27 \text{kV} \]

Initial voltages:

\[ V_{c1,0} := V_{\text{pk}} \quad V_{c2,0} := -V_{\text{pk}} \]

\[ V_{LL} = 13.8 \text{kV} \]

**Peak line to ground voltage**
\[ Z_{ep} = -jX_c \]

\[ Z_{ep} = jX_L - jX_c \]

\[ X_c > X_L \]

What is phase difference between \( V_{cap} \) and \( I_{cap} \)?

\[ 0^\circ \rightarrow +90^\circ \]

\[ \frac{V_{cap}}{-jX_c} \]

V_{cap} when breaker opens clears.
2 stored charge +Vph

close this breaker

reclose

close breaker

m-1-38

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University of Idaho
Initial current:
\[ I_{pk} := \frac{V_{c1,0} - V_{c2,0}}{R_{\text{limiting}}} \]
\[ I_{pk} = 225.35 \text{ A} \]

Current limiting resistor has big impact:

We also need to calculate the energy dissipated in the resistor:

\[ E_{\text{diss, R}} := \frac{1}{2} \left( \frac{C_1 \cdot C_2}{C_1 + C_2} \right) \left( V_{c1,0} - V_{c2,0} \right)^2 \]
\[ E_{\text{diss, R}} = 212.21 \text{ kJ} \]

\[ E_{C_1, \text{init}} = \frac{1}{2} C V_{c0}^2 \]

**Computer Simulation Results:**

Calculate \( V_{\text{final}} \) as a check.

\[ Q_{\text{init}} := V_{c1,0} \cdot C_1 + V_{c2,0} \cdot C_2 \quad Q_{\text{init}} = 14.12 \text{ C} \]

\[ Q_{\text{final}} := Q_{\text{init}} \]

Both capacitors see the same final voltage since the resistor current is 0, so:

\[ Q_{\text{final}} = V_{\text{final}} \cdot C_1 + V_{\text{final}} \cdot C_2 \]

\[ V_{\text{final}} := \frac{Q_{\text{final}}}{C_1 + C_2} \quad V_{\text{final}} = 3.756 \text{ kV} \]

Time constant:

\[ R_{\text{limiting}} \left( \frac{C_1 \cdot C_2}{C_1 + C_2} \right) = 83.57 \text{ ms} \]

**ATPDraw schematic:**

![ATPDraw schematic](image)
ATP Input Data File:

BEGIN NEW DATA CASE
C ------------------------------------------------------------------------
C Generated by ATPDRAW February, Saturday 23, 2008
C A Bonneville Power Administration program
C by H. K. Hedalen at SEFAS/NTNU - NORWAY 1994-2006
C ------------------------------------------------------------------------
C  dT  >= Tmax  >= Xopt  >= Copt
     5.E-5  1.

500   1    1    1    1  0  0  1  0
C 1  2  3  4  5  6  7  8
C 34567890123456789012345678901234567890123456789012345678901234567890

/BRANCH
C  < n1  >= n2  >=<ref1><ref2>< R  >= L  >= C  >
C  < n1  >= n2  >=<ref1><ref2>< R  >= A  >= B  >=<Leng><><0
VC1     2507.2  2
VC2     1253.6  2
IS   VC2  100.

/SWITCH
C  < n 1>< n 2>< Term1 >= Top/Tde >= Ie >=<Vf/CLOP>=< type >
VC1   IS   .01   1.E3  1

/INITIAL
2VC1    11270.
2VC2   -11270.
3VC1    11270.
3VC2   -11270.

/OUTPUT
BLANK BRANCH
BLANK SWITCH

PSCAD Schematic  Note that there is a charging circuit for each capacitor now