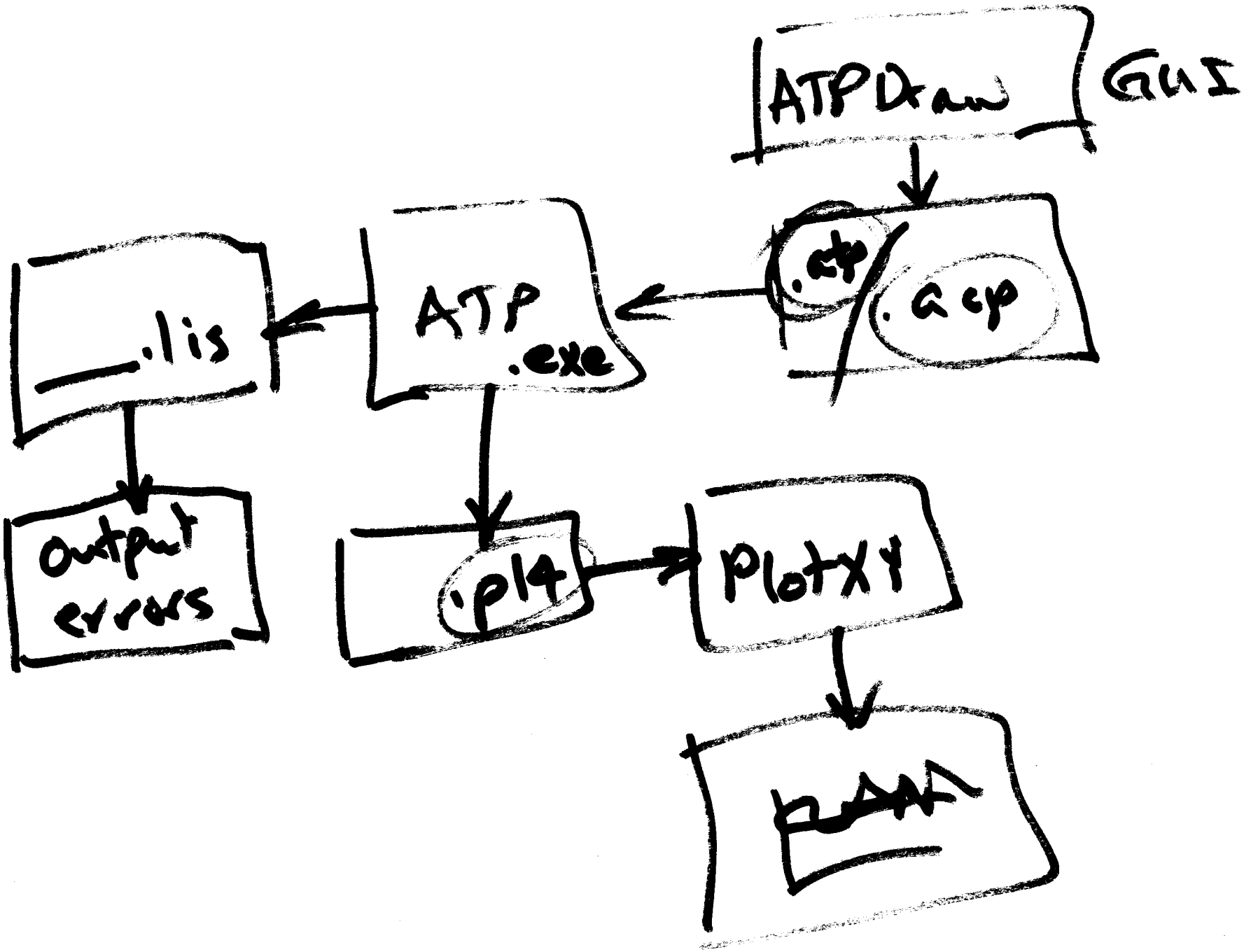
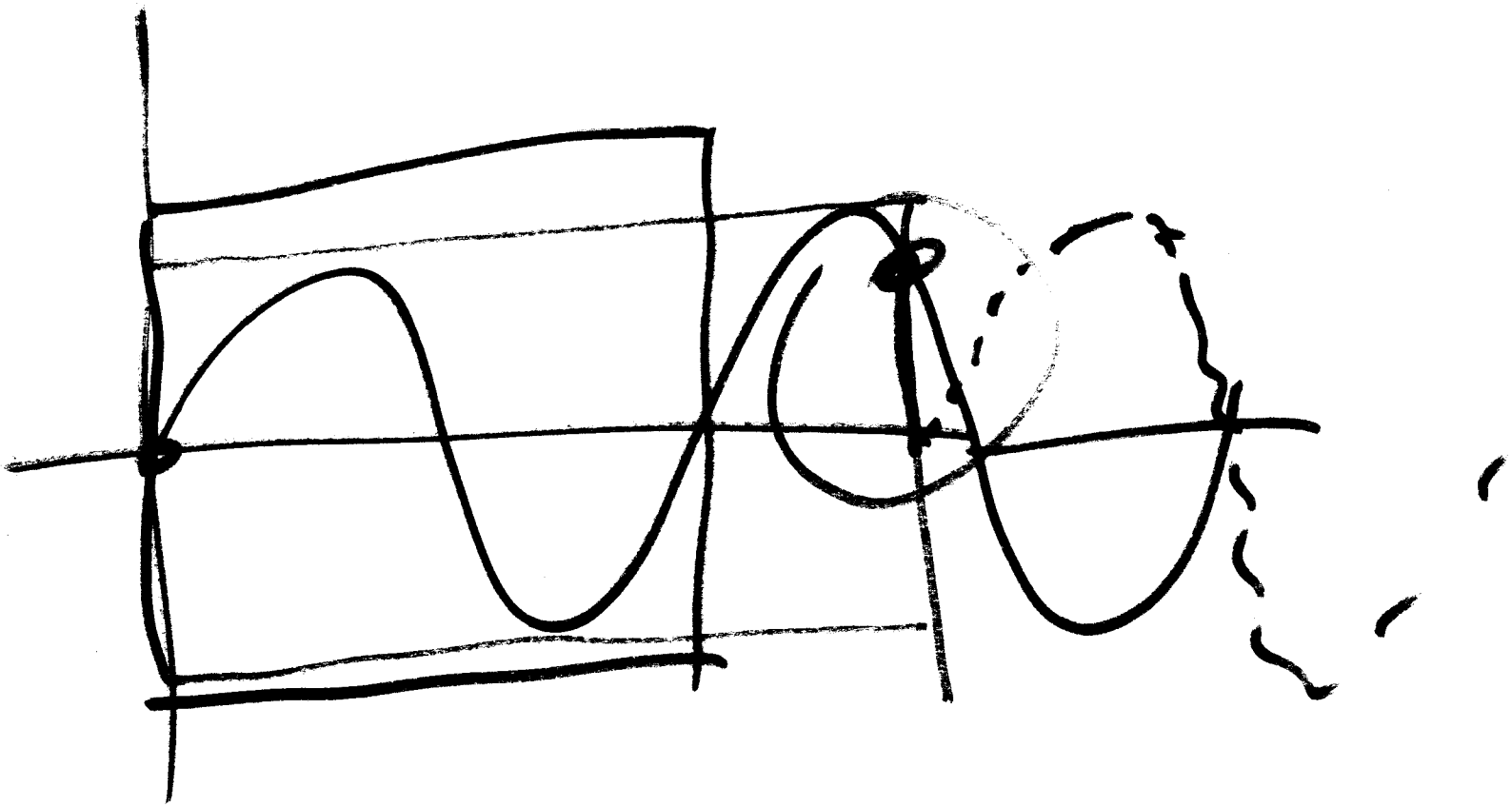
EE 5220 - Lecture 34 Mon Apr 1, 2024

Topics for Today:

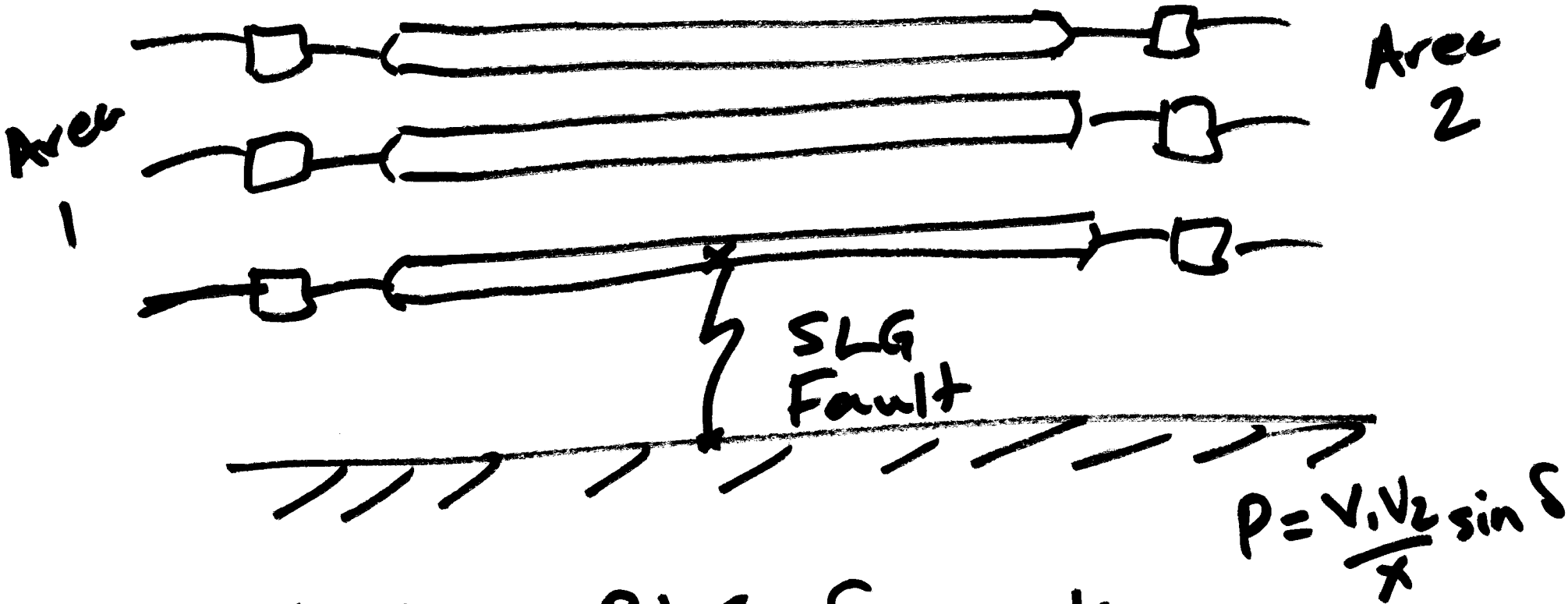
- Course Info:
  - Web page: https://pages.mtu.edu/~bamork/ee5220/
  - Book, references, syllabus, more are on web page.
  - Software - Matlab. ATP/EMTP [License - www.emtp.org] ATP tutorials posted on our course web page
  - EE5220-L@mtu.edu (participation = min half letter grade)

- Term Project - Journal paper analysis - completed by 9am Tues Apr 9th
- Line Switching
  - Single pole tripping and reclosing
  - Secondary arc interruption
- Lightning - Ch.14
  - Basic characteristics
  - Statistical approach
- Next: insulation coordination - Chapters 15.

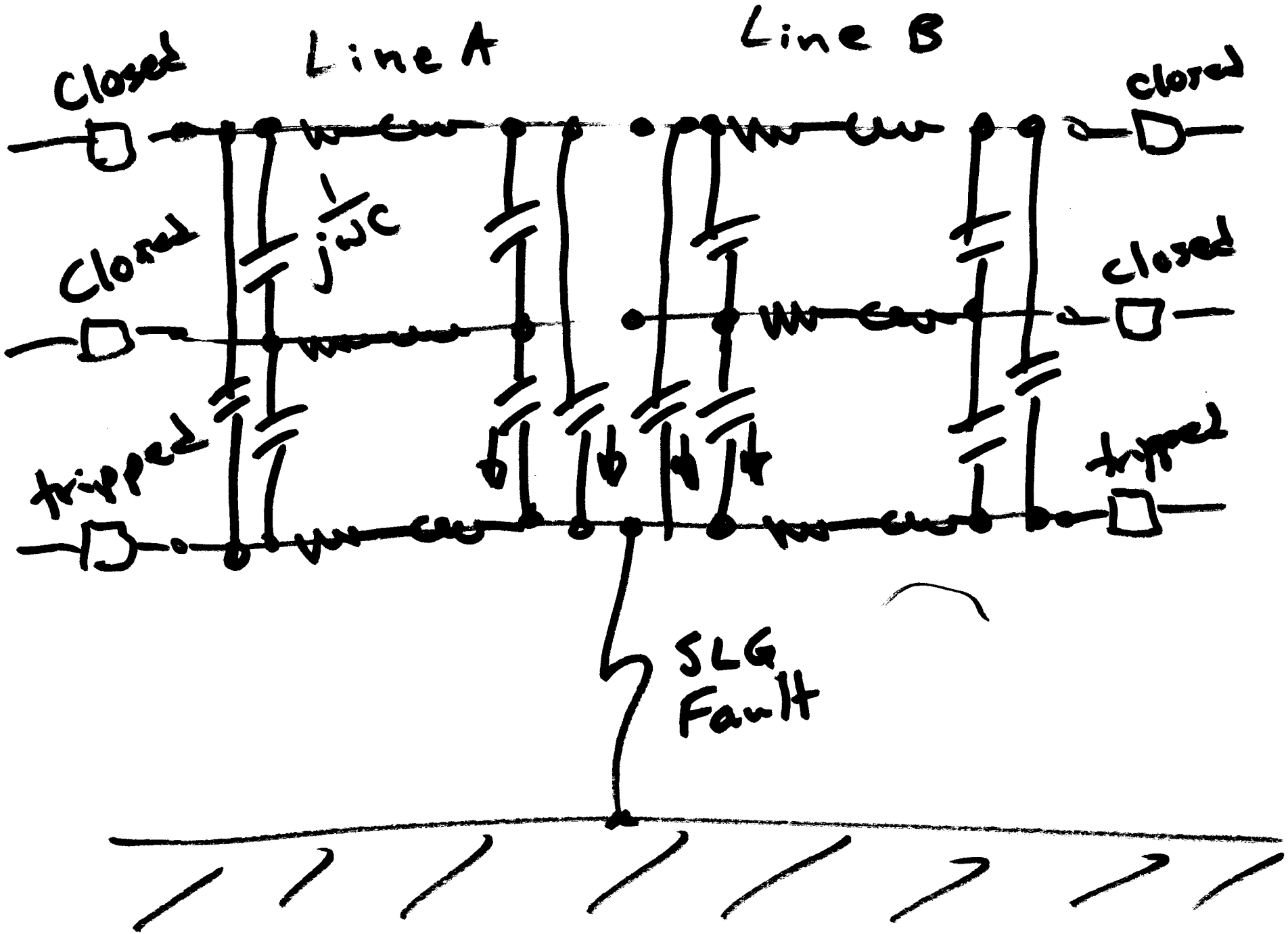

ATPDraw
GUI
.cdp
.acp
ATP
.exe
.lis
Output
errors
.pl4
PlotXY

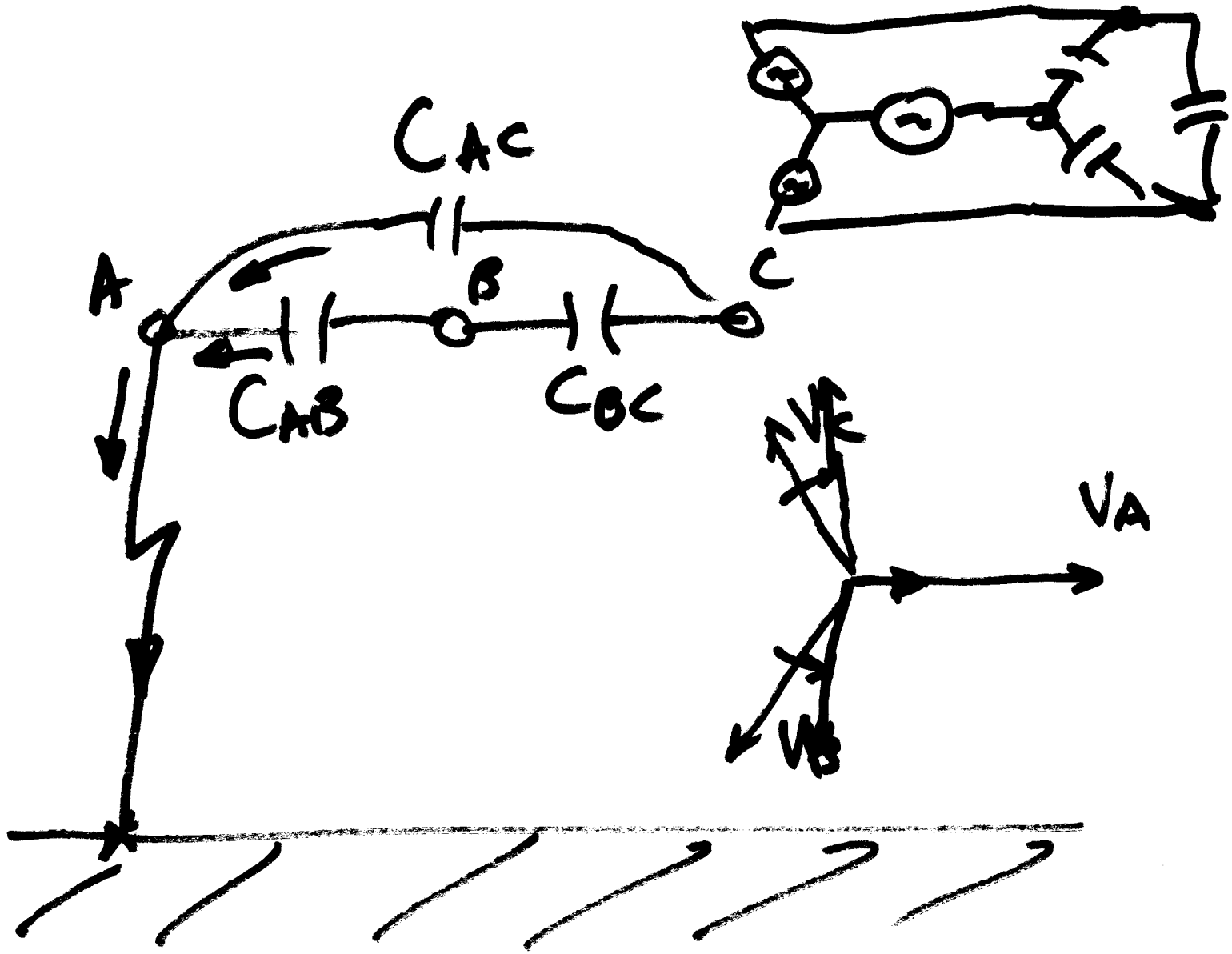


SPT - Single-Pole Tripping



- Maintain P & Q flows thru intact phases.
- Don't "lose" system tie due to large "standing V angle" as can happen w/ 3-~~ph~~pole trip/recl.


Line A
Line B
Closed
Closed
tripped
closed
closed
tripped
$\frac{1}{j\omega C}$
SLG
Fault

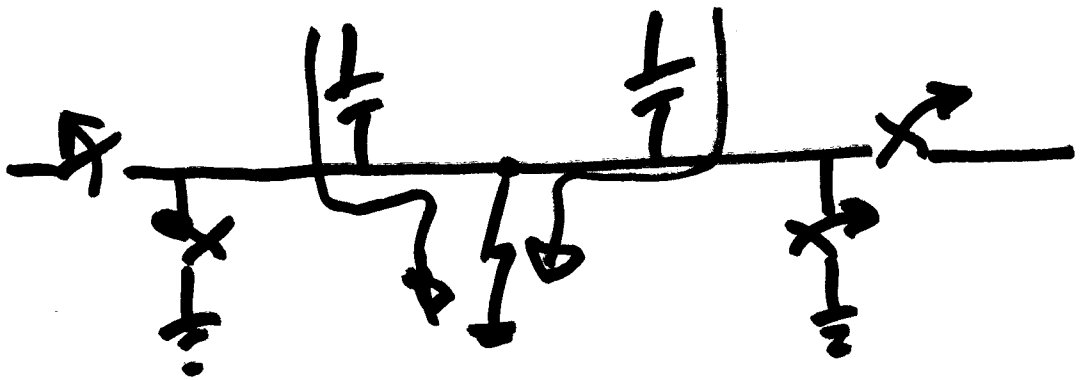


Capacitive coupling B-A and C-A induces voltage on A which continues to provide a "secondary (fault) arc current".

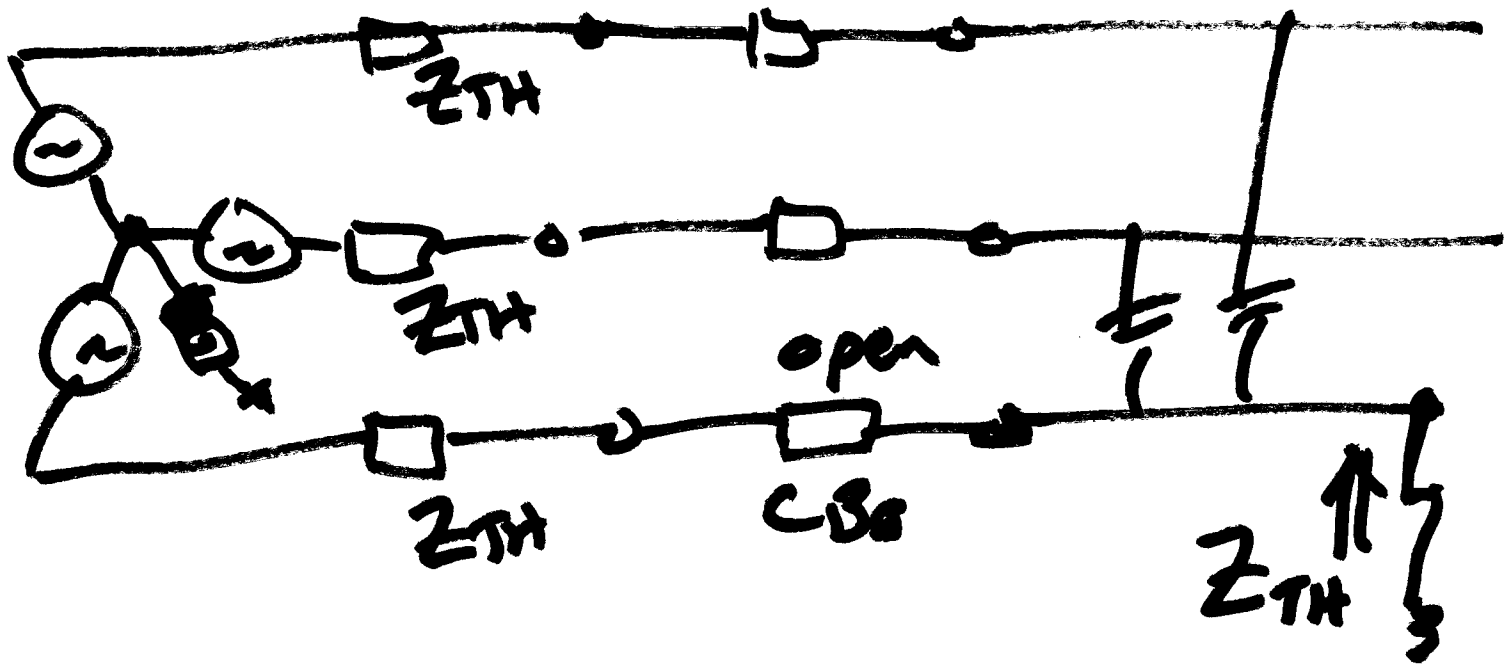
Extinguishing Secondary Arc:

- Short Lines: self-extinguishing
- Longer Lines:
  - Grounding Switch (High-speed)
  - ——————————
  - Resonant Grounding

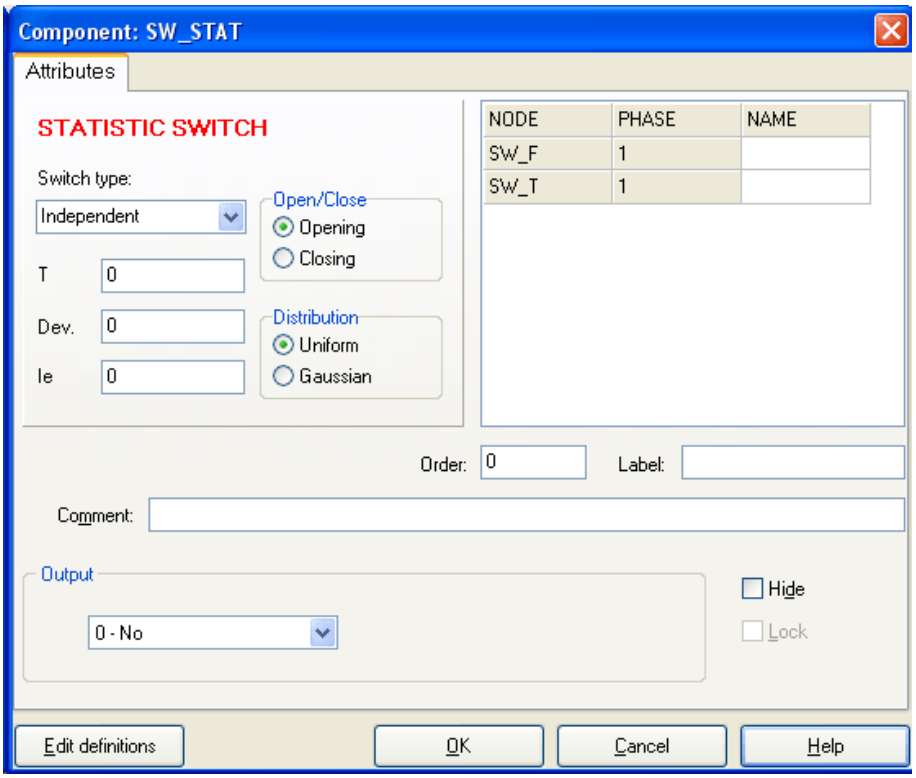
Gnd Sw:

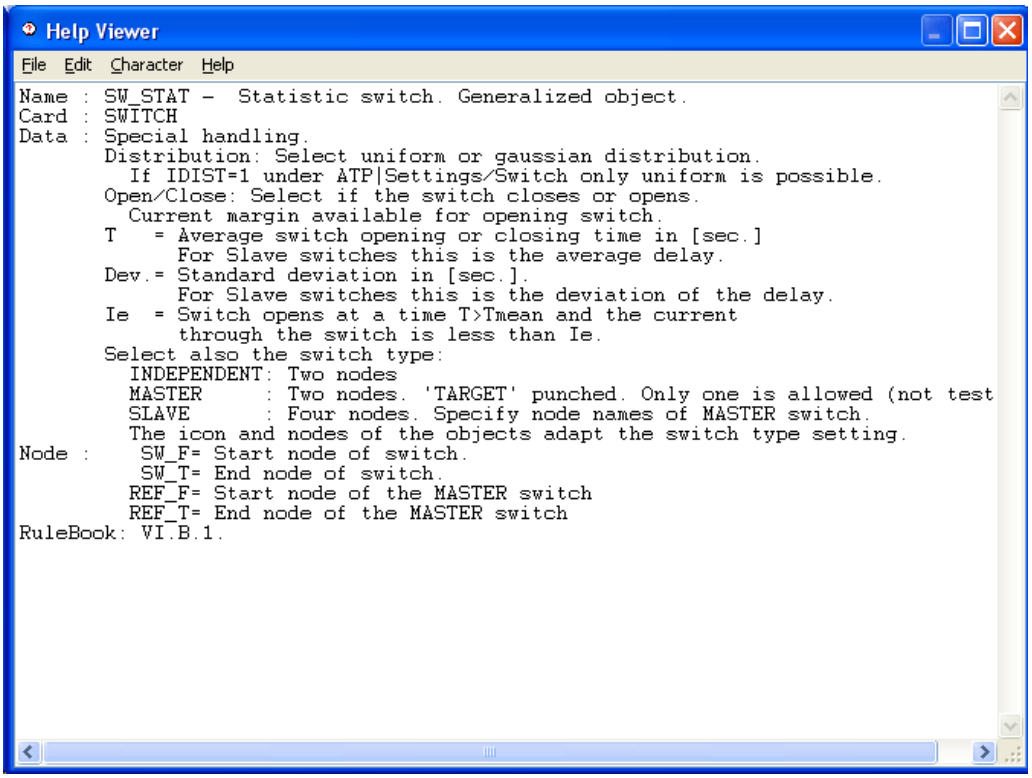


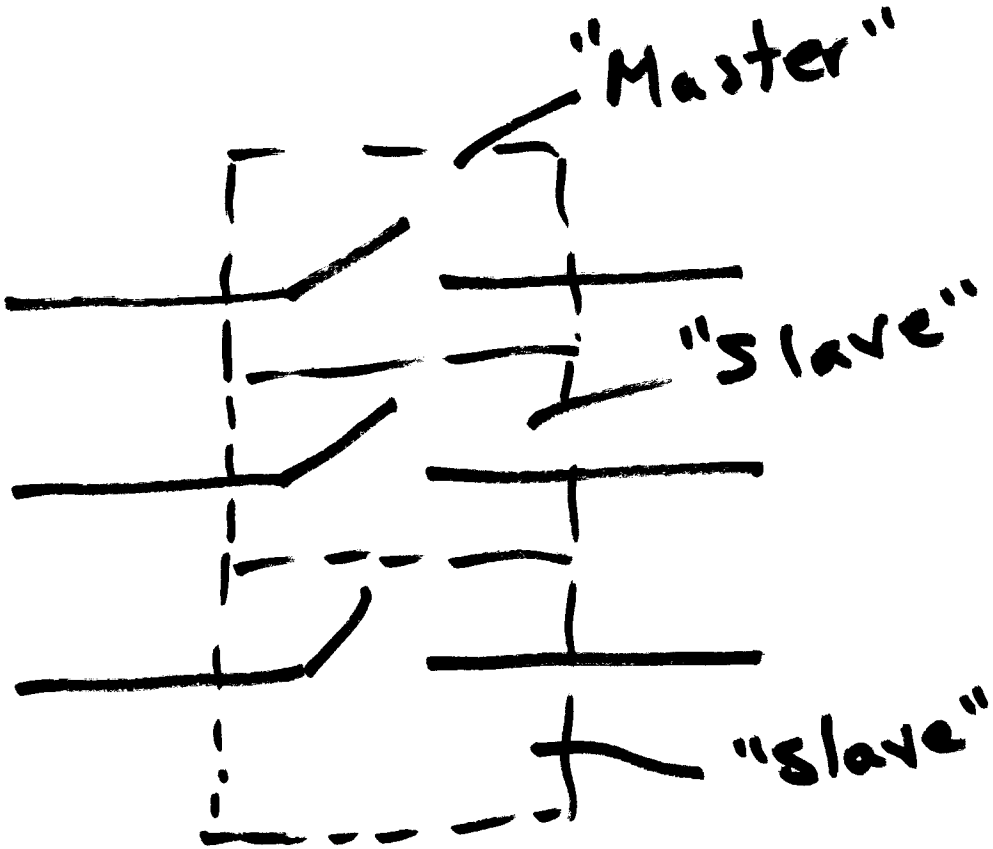
Resonant Grounding



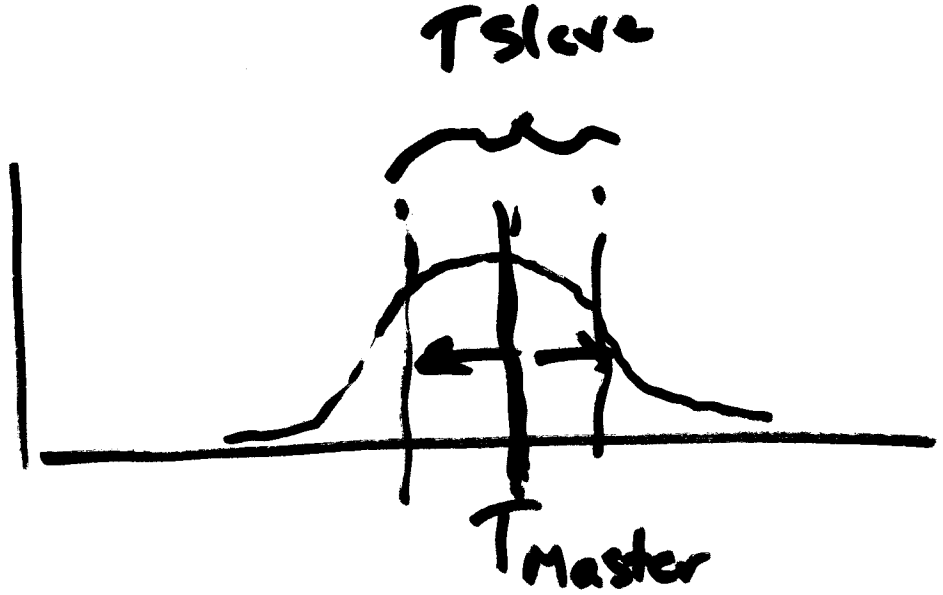
Parallel L-C impedance path that is resonant.


Component: SW_STAT
Attributes
STATISTIC SWITCH
Switch type:
Independent
Open/Close
Opening
Closing
T
0
Dev.
0
Distribution
Uniform
Gaussian
Ie
0
NODE
PHASE
NAME
SW_F
1
SW_T
1
Order:
0
Label:
Comment:
Output
0 - No
Hide
Lock
Edit definitions
OK
Cancel
Help

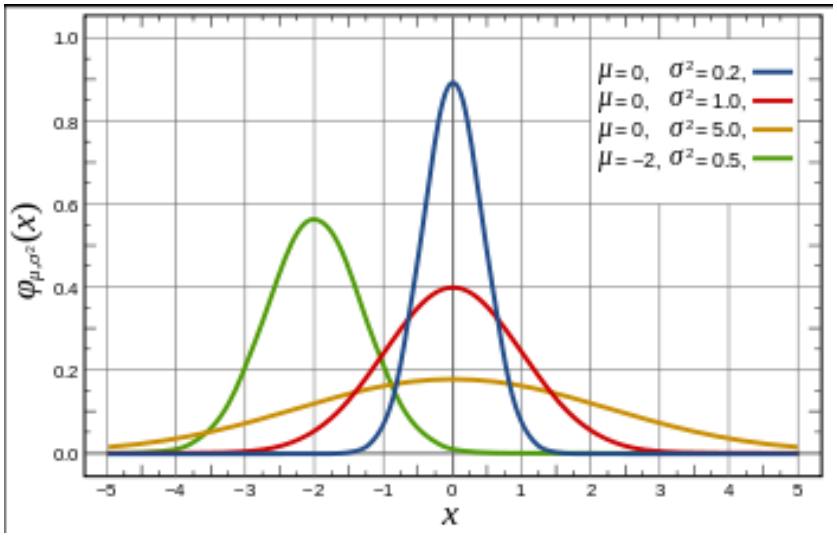

Help Viewer
File Edit Character Help
Name : SW_STAT - Statistic switch. Generalized object.
Card : SWITCH
Data : Special handling.
Distribution: Select uniform or gaussian distribution.
If IDIST=1 under ATP|Settings/Switch only uniform is possible.
Open/Close: Select if the switch closes or opens.
Current margin available for opening switch.
T = Average switch opening or closing time in [sec.]
For Slave switches this is the average delay.
Dev.= Standard deviation in [sec.].
For Slave switches this is the deviation of the delay.
Ie = Switch opens at a time T>Tmean and the current
through the switch is less than Ie.
Select also the switch type:
INDEPENDENT: Two nodes
MASTER : Two nodes. 'TARGET' punched. Only one is allowed (not test
SLAVE : Four nodes. Specify node names of MASTER switch.
The icon and nodes of the objects adapt the switch type setting.
Node : SW_F= Start node of switch.
SW_T= End node of switch.
REF_F= Start node of the MASTER switch
REF_T= End node of the MASTER switch
RuleBook: VI.B.1.



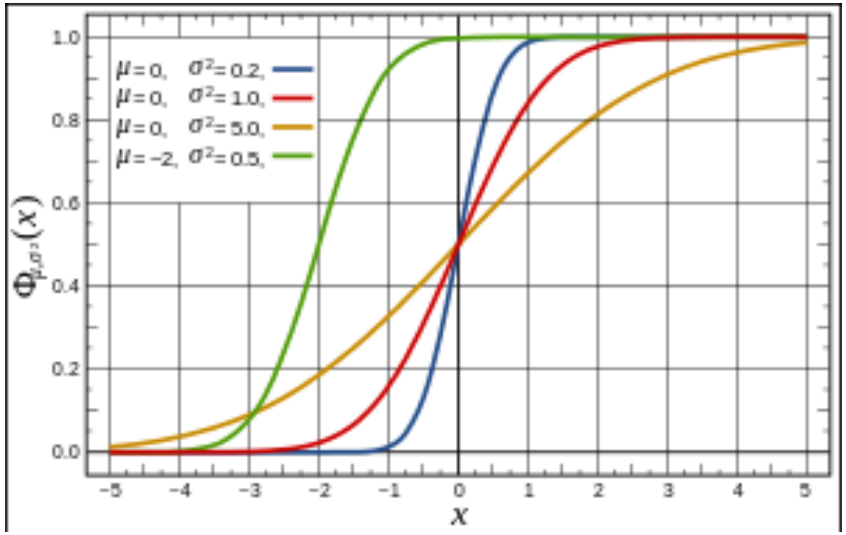
Pole Span -



In probability theory, a probability density function (PDF), or density of a continuous random variable, is a function that describes the relative likelihood for this random variable to take on a given value. The probability of the random variable falling within a particular range of values is given by the integral of this variable's density over that range-that is, it is given by the area under the density function but above the horizontal axis and between the lowest and greatest values of the range. The probability density function is nonnegative everywhere, and its integral over the entire space is equal to one.



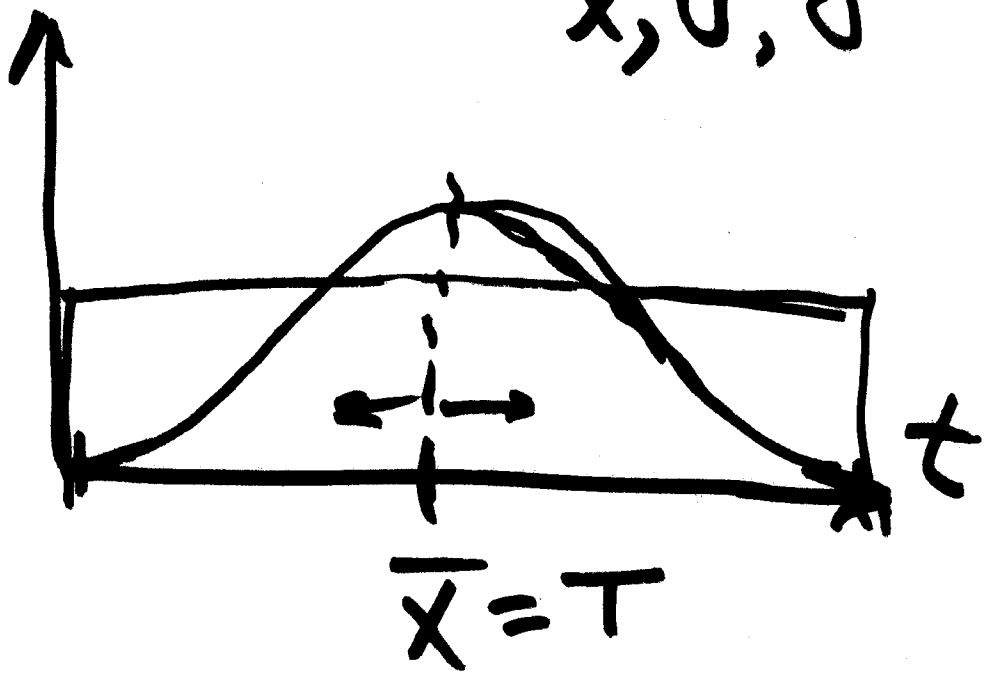
In probability theory, the normal (or Gaussian) distribution is a very common continuous probability distribution. Normal distributions are important in statistics and are often used in the natural and social sciences to represent real-valued random variables whose distributions are not known.



In probability theory and statistics, the cumulative distribution function (CDF) of a real-valued random variable X, or just distribution function of X, evaluated at x, is the probability that X will take a value less than or equal to x.

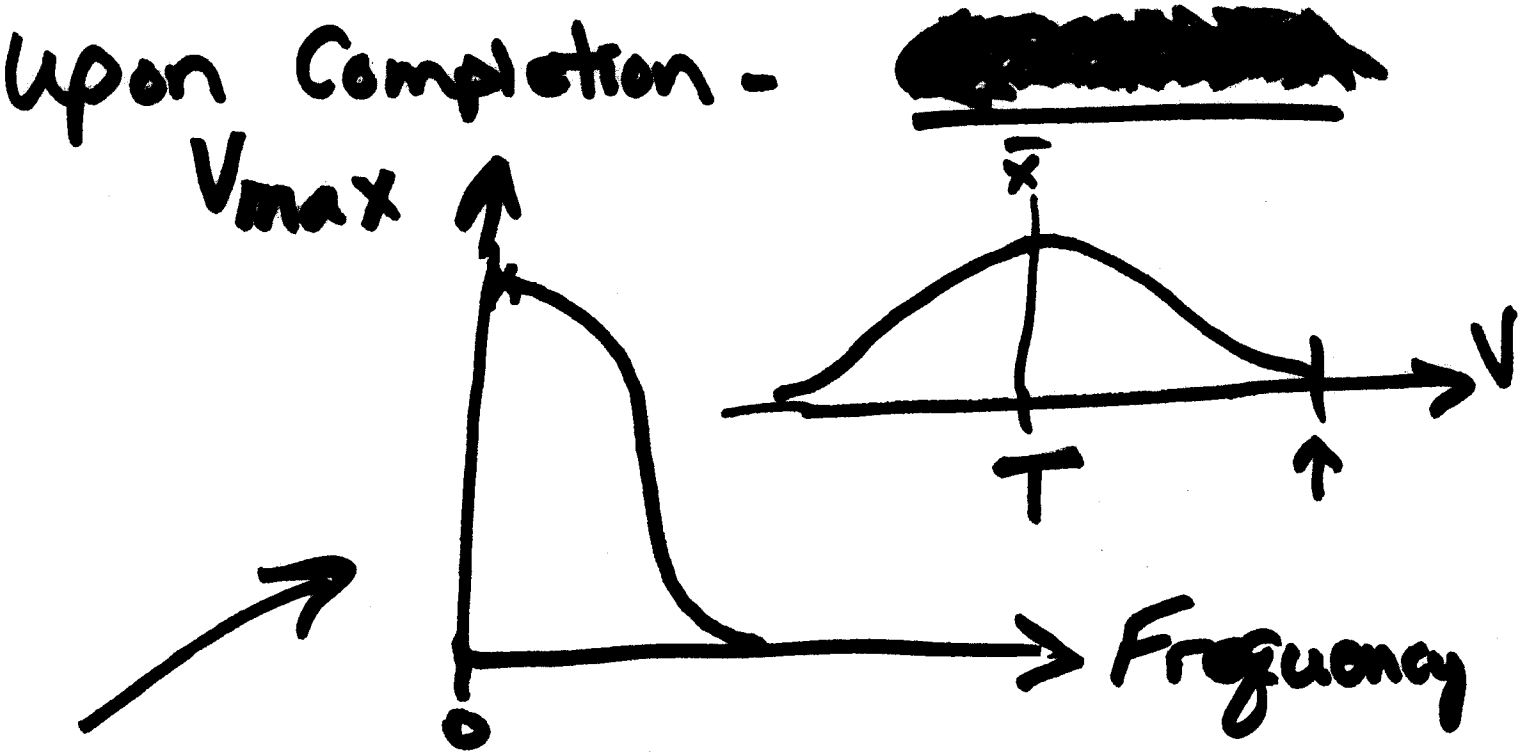
Switch – Statistical

$\bar{x}, \sigma, \sigma^2$



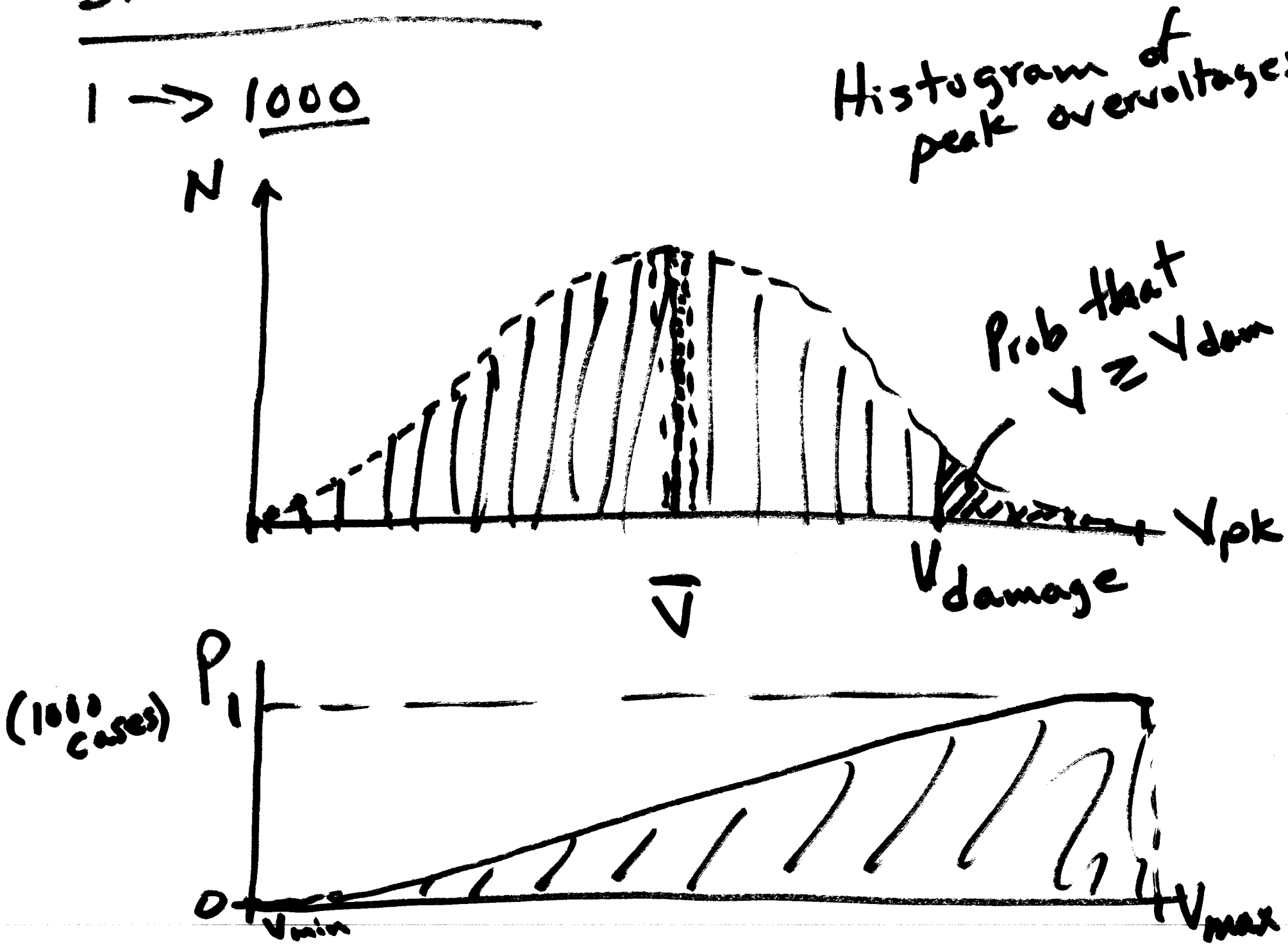
Master – Slave

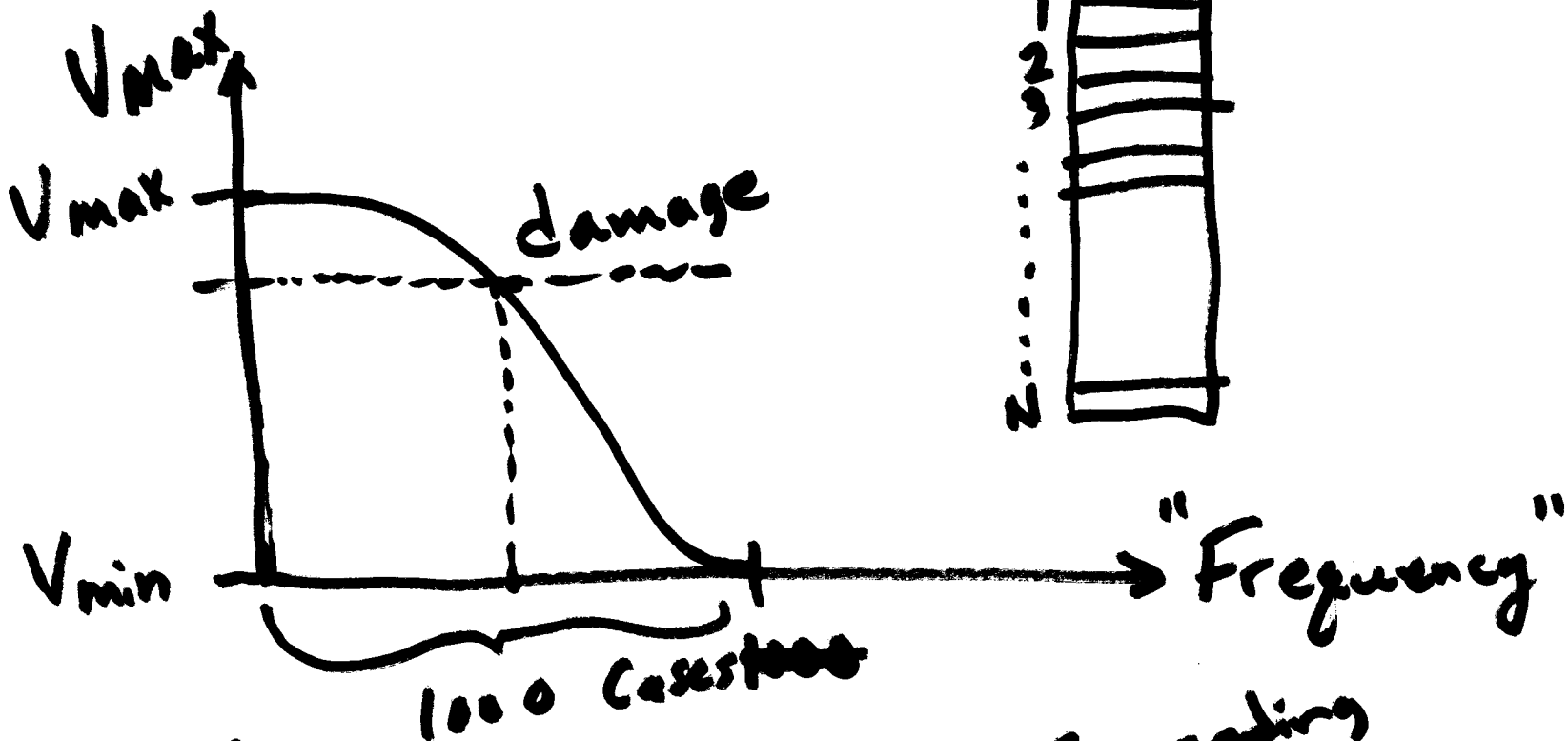
Upon Completion -

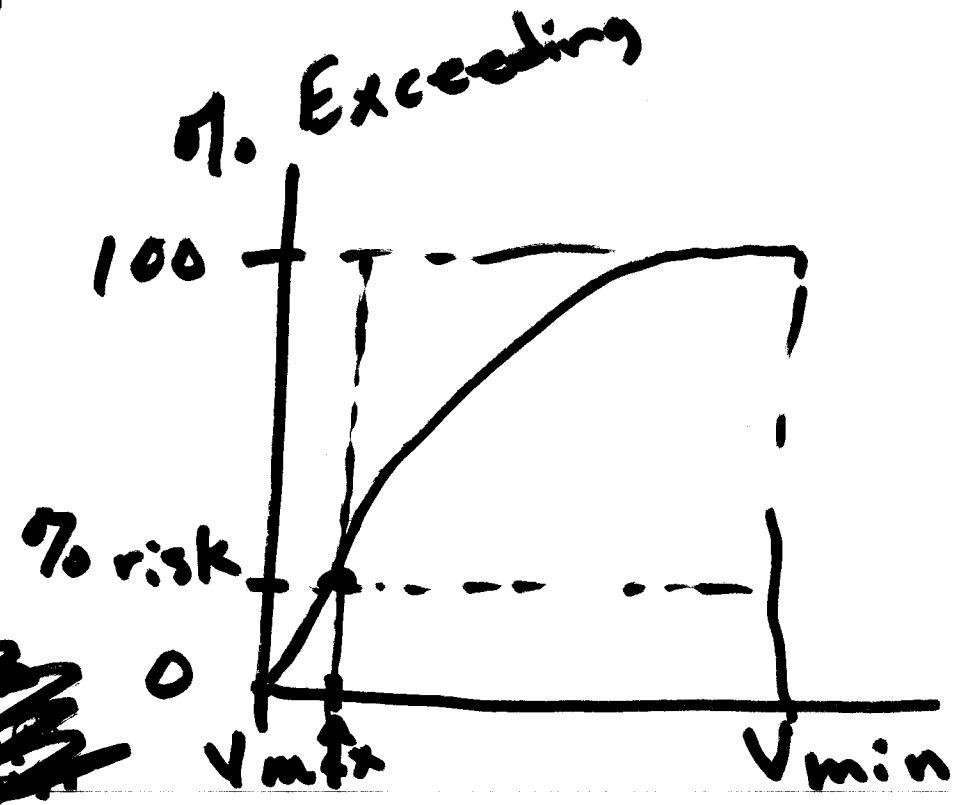
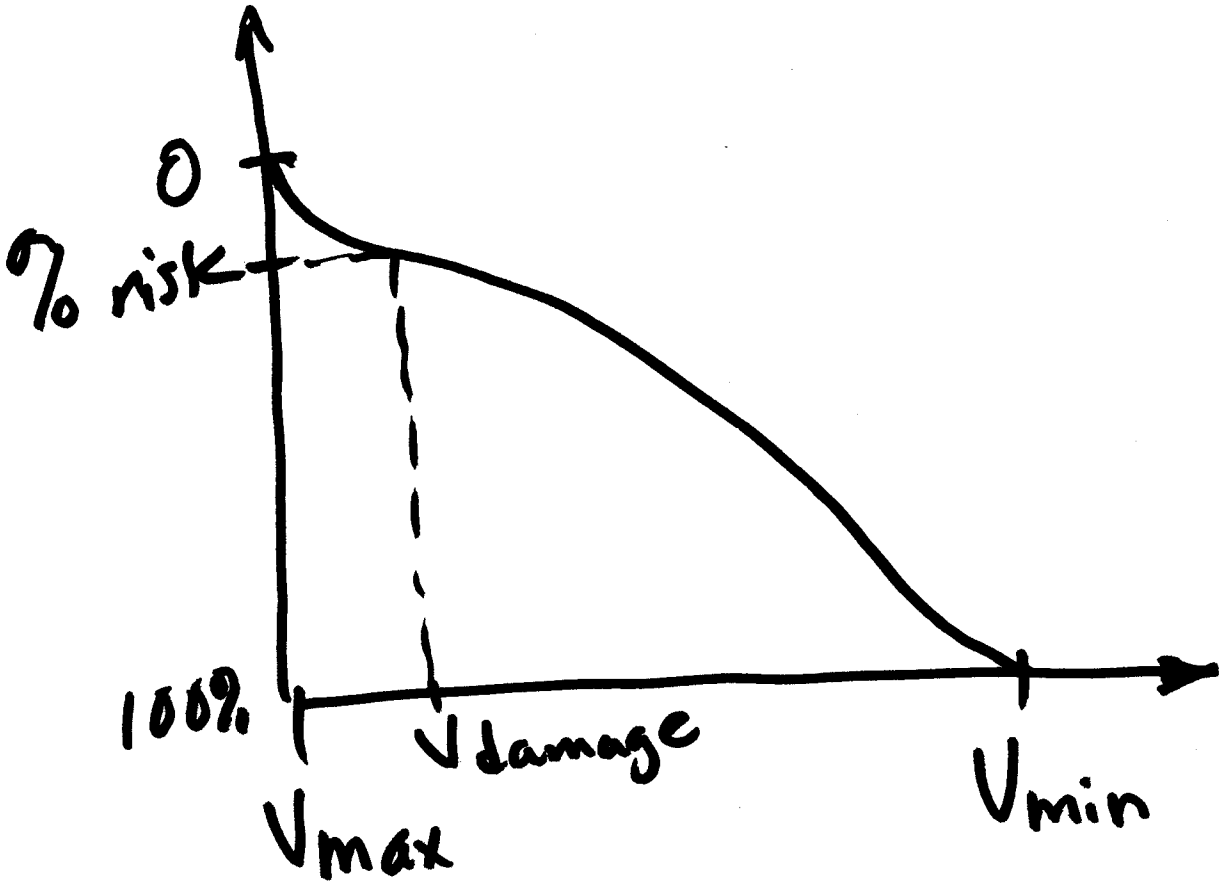


Statistical Sims

1 → 1000




Vmax
Vmax
damage
Vmin
"Frequency"
1000 Cases
Vmax
1
2
3
N


% Exceeding
100
% risk
0
Vmax
Vmin

Best visualization: