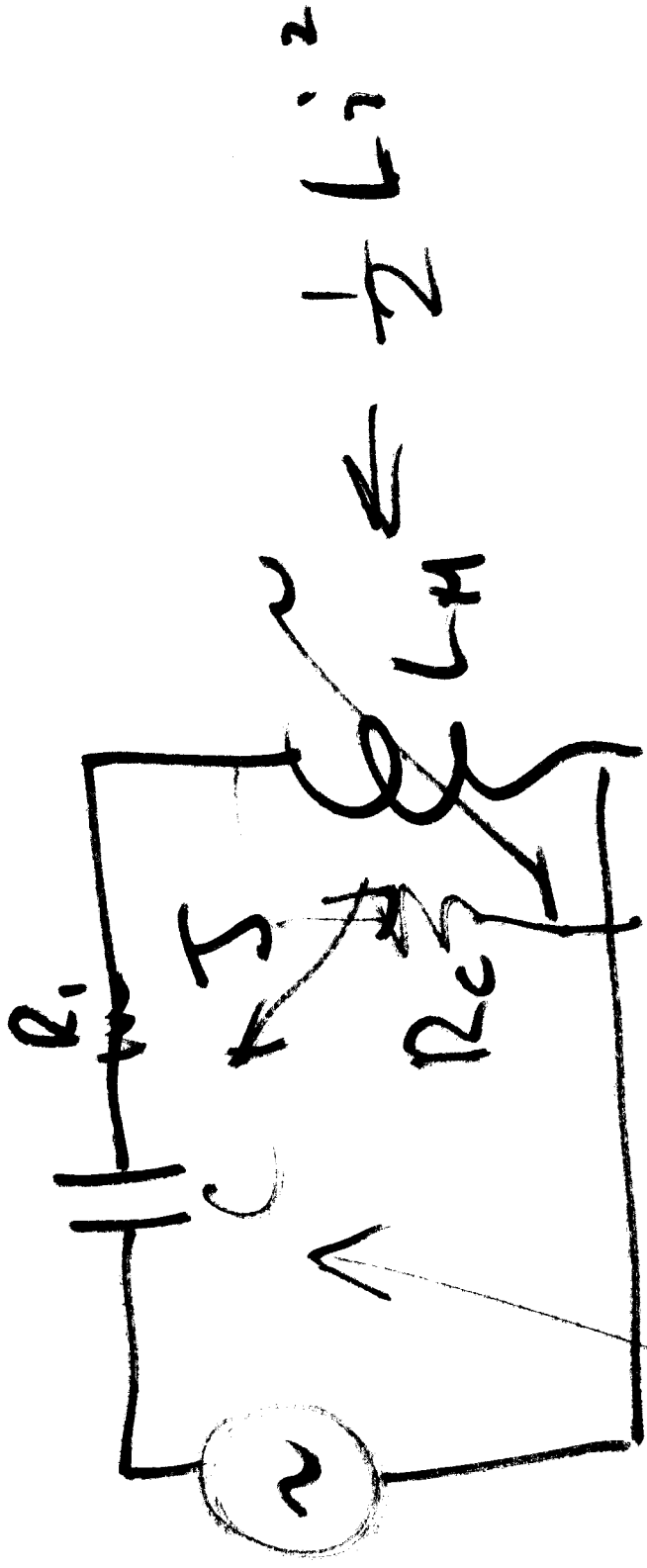


Topics for Today:

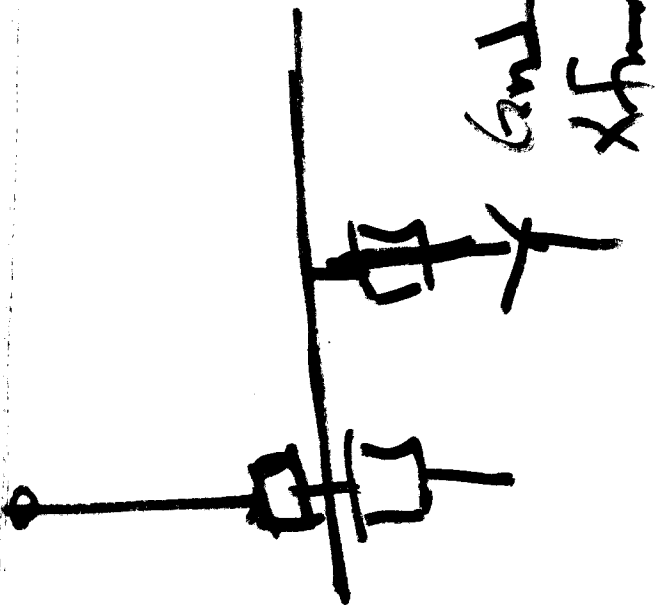
- Course Info:
 - Web page: <http://www.ee.mtu.edu/faculty/bamork/ee5220/>
 - Book, references, syllabus, more are on web page.
 - Software - Matlab. ATP/EMTP [License - www.emtp.org] ATP tutorials posted on our course web page
 - EE5220-L@mtu.edu (participation = half letter grade, 5%)
- Final Report - complete by Fri April 27th
- Term Project - On-campus teams present on Mon Apr 30th 3:00pm
- Recap of Ferroresonance, demo ATP simulation
- L36 notes - Dealing with Ferroresonance paper - practical understanding
- Hmwk 10 due Mon Apr 23rd 9am. Discussion - Prob. 14.5
- Transient overvoltages due to lightning - Chapters 15.
 - Breakdown characteristics
 - Probabilistic approach
- Insulation design and coordination - Chapter 16
 - Shielding design for overhead lines



$$\frac{1}{2} CV^2$$

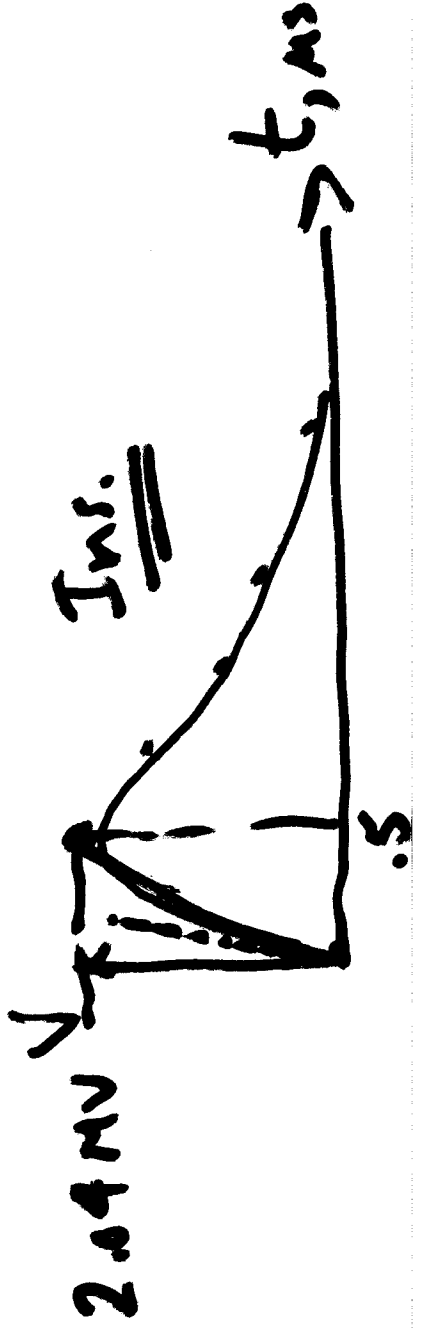
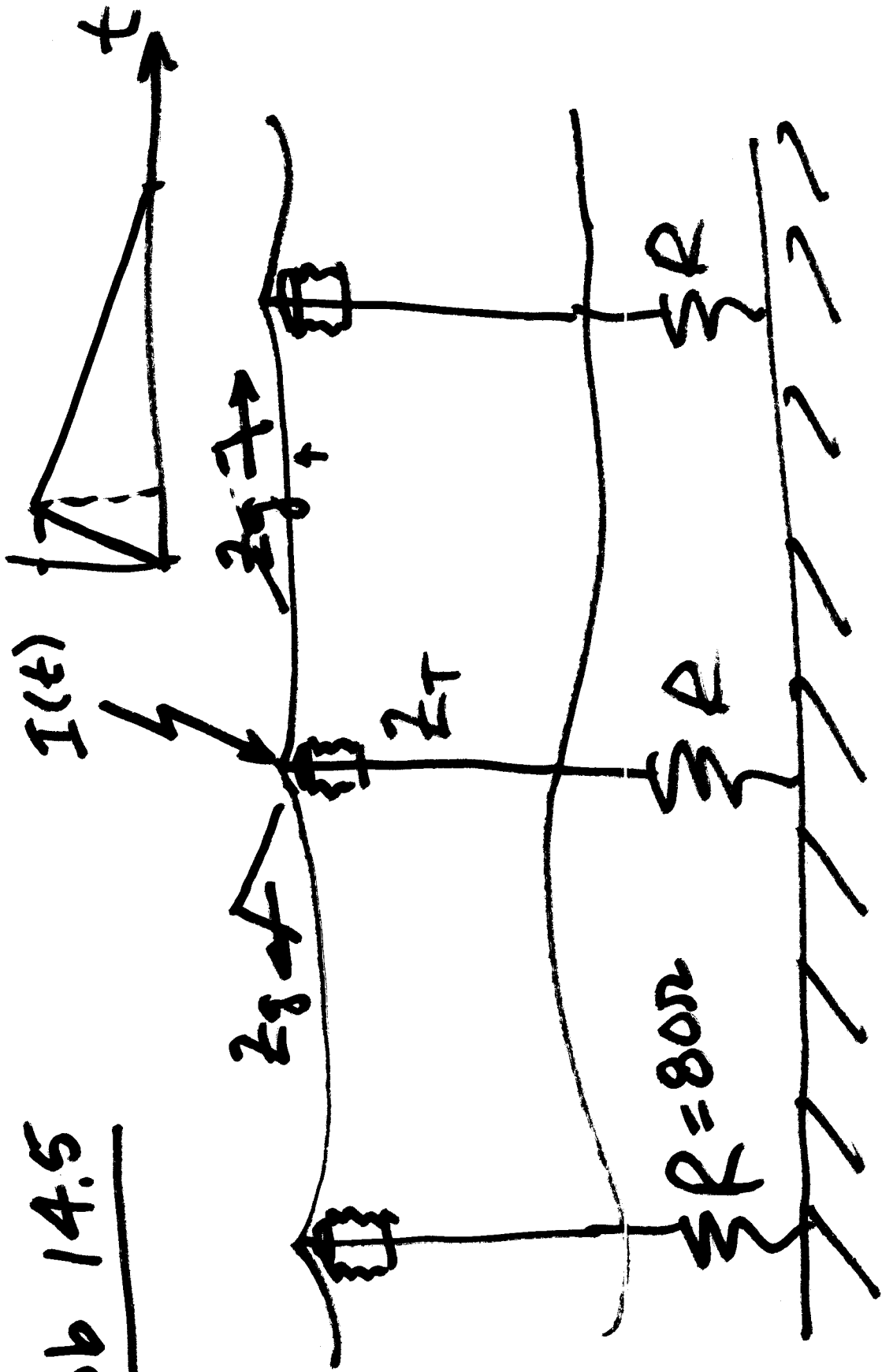
△
33

△
33



72 VTs

Prob 14.5



$\mu = \text{mean}$

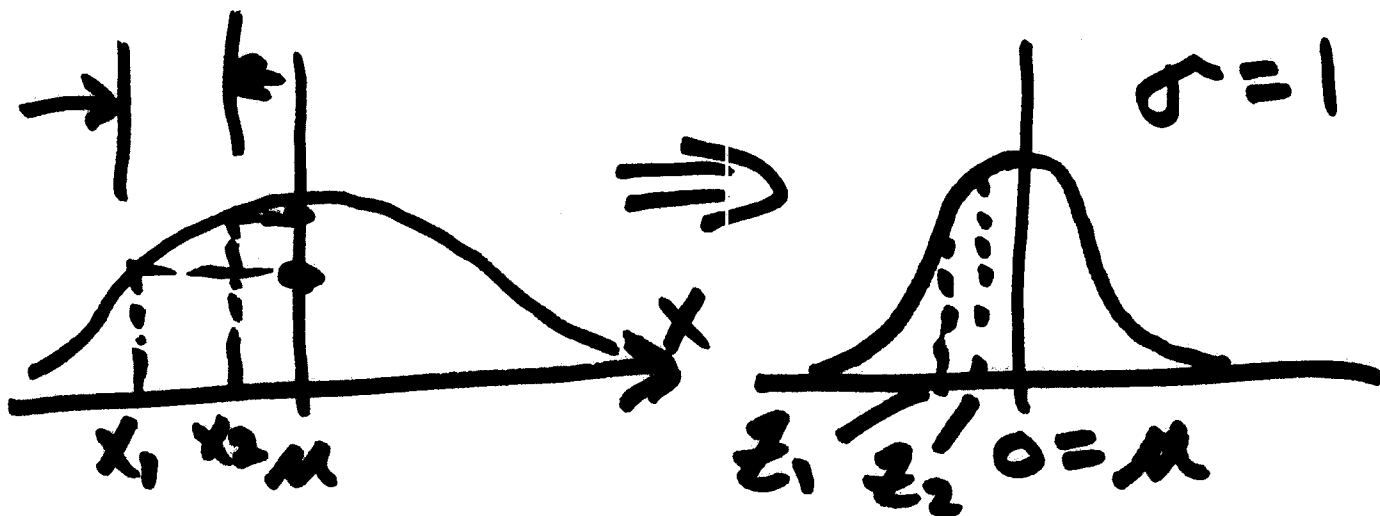
$\sigma = \text{std. dev.}$

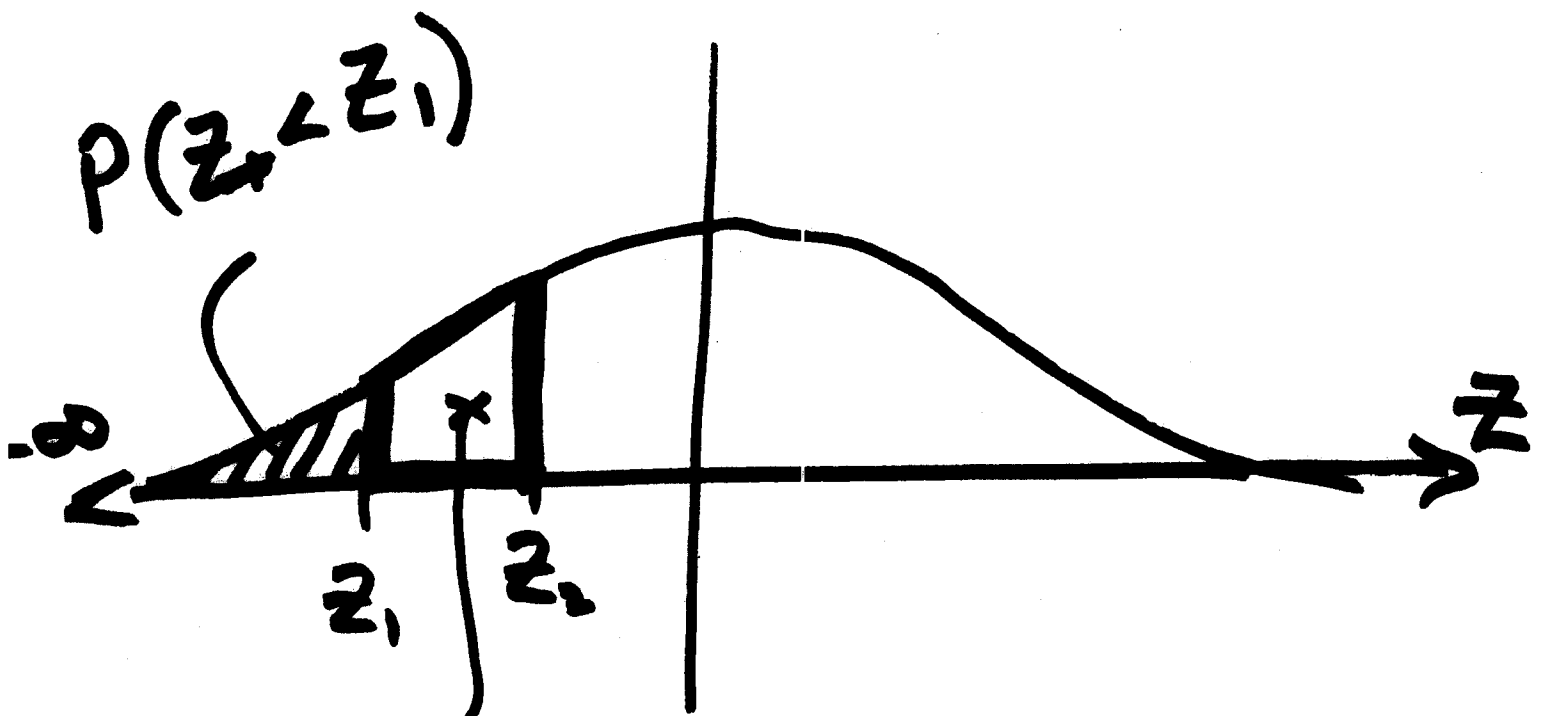
Gaussian Dist:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\left[\frac{(x-\mu)^2}{2\sigma^2}\right]}$$

$Z = \text{Normal Random Var.}$
($\sigma = 1, \mu = 0$)

$$Z = \frac{X - \mu}{\sigma}$$





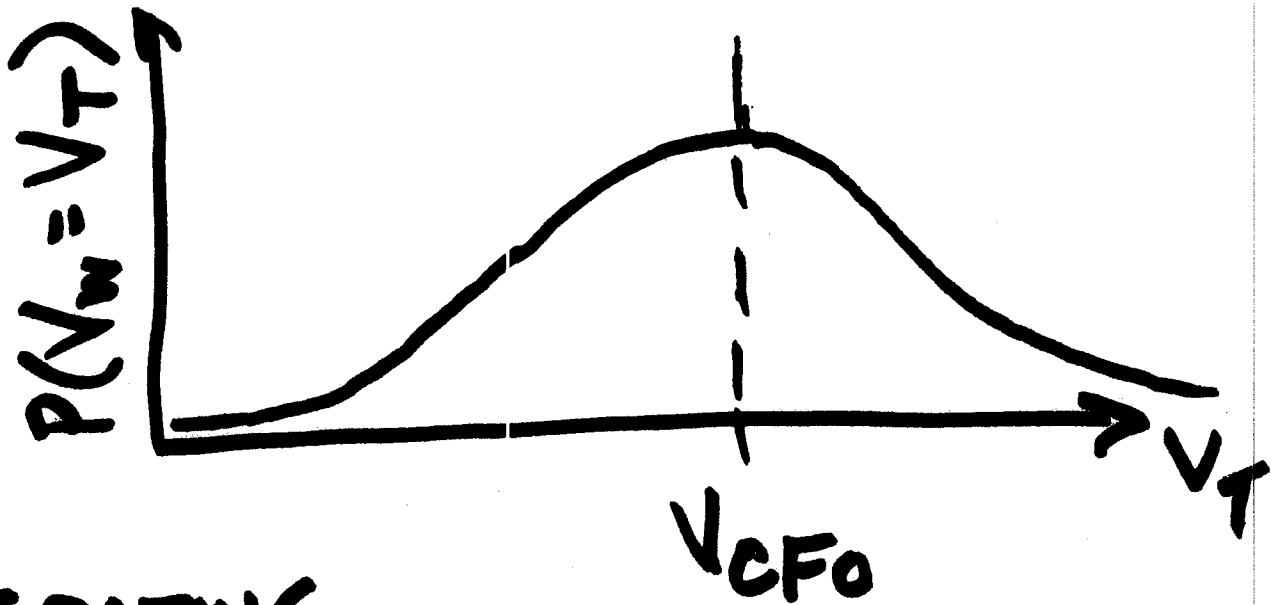
$$P(z_1 < Z < z_2)$$

$$= P(Z < z_2)$$

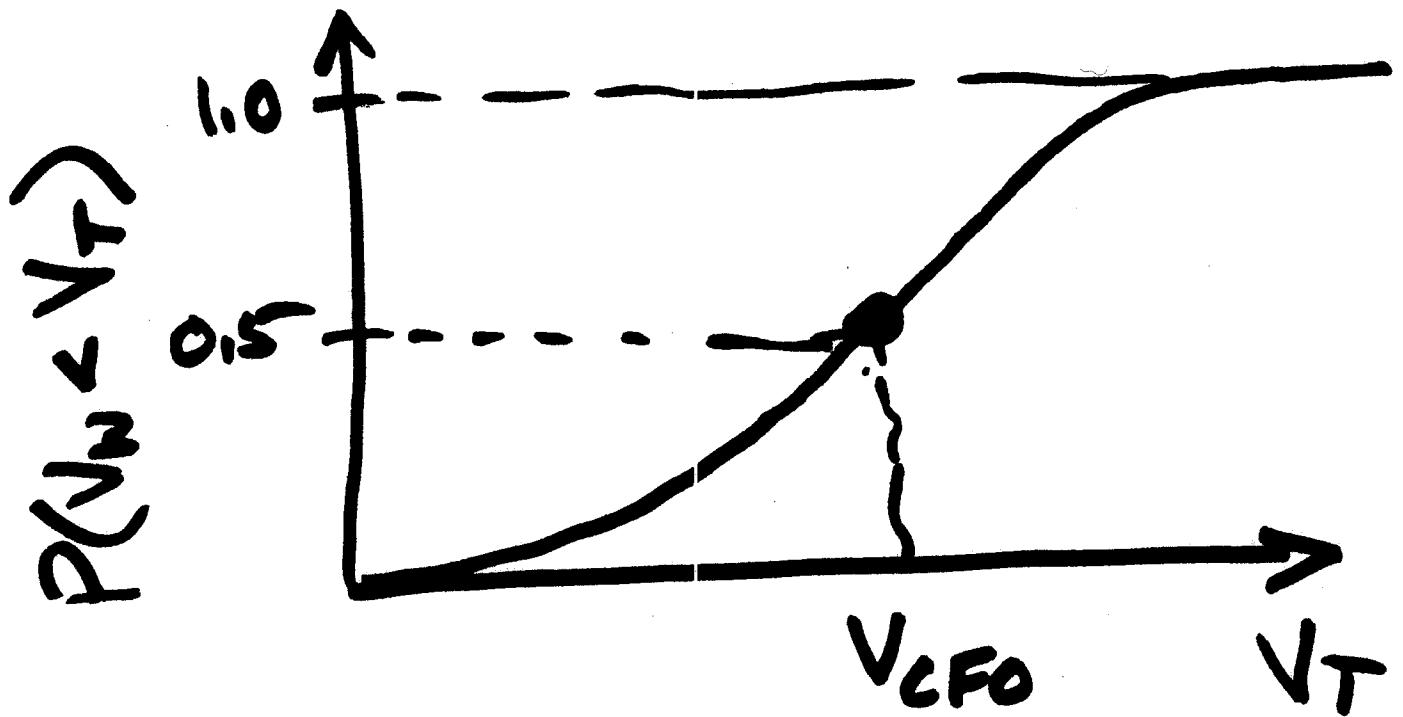
$$- P(Z < z_1)$$

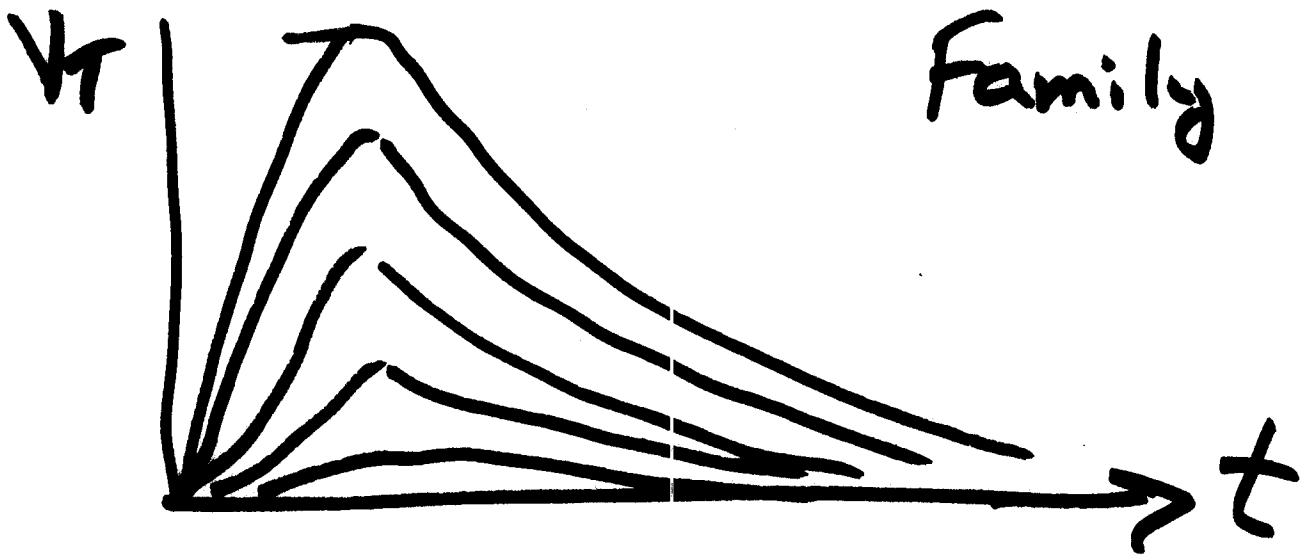
177.

Statistical Relationships

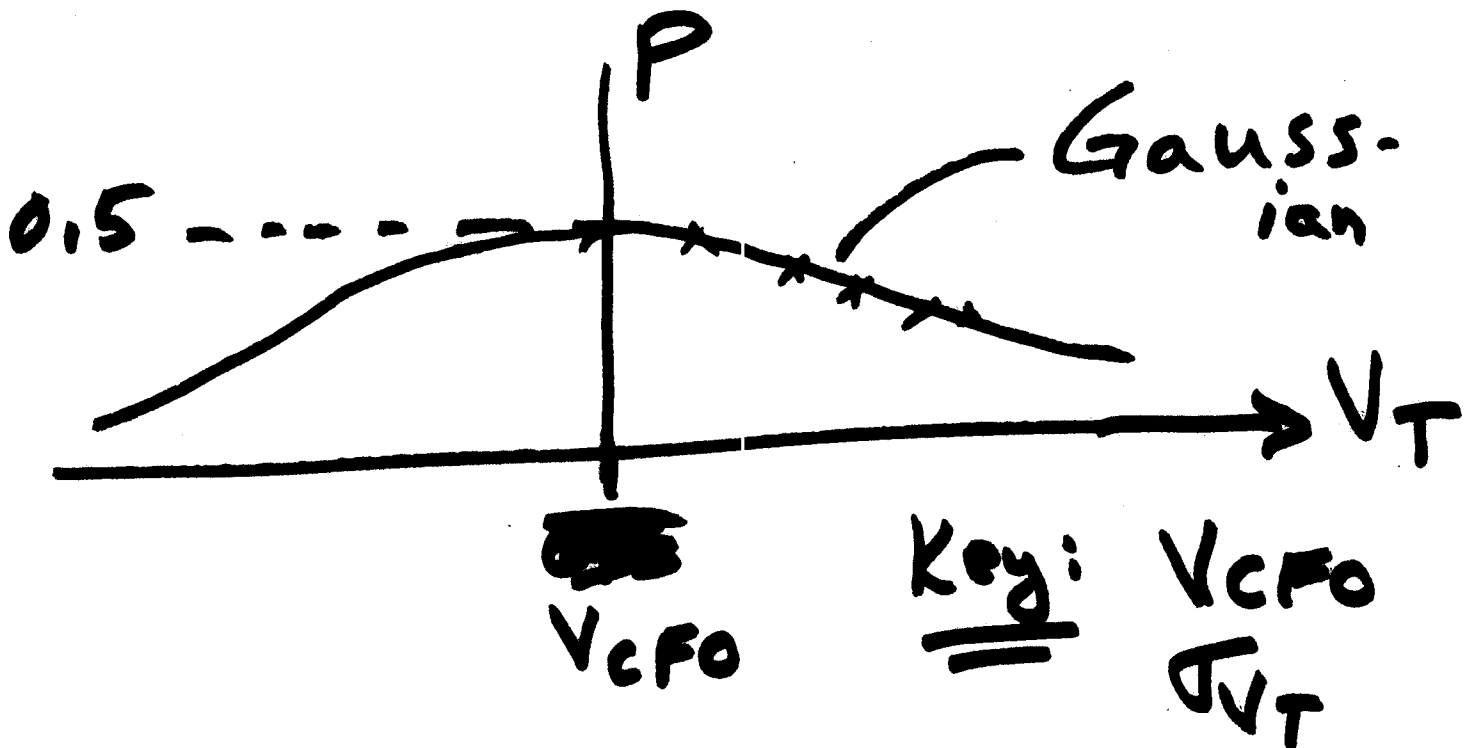


INTEGRATING



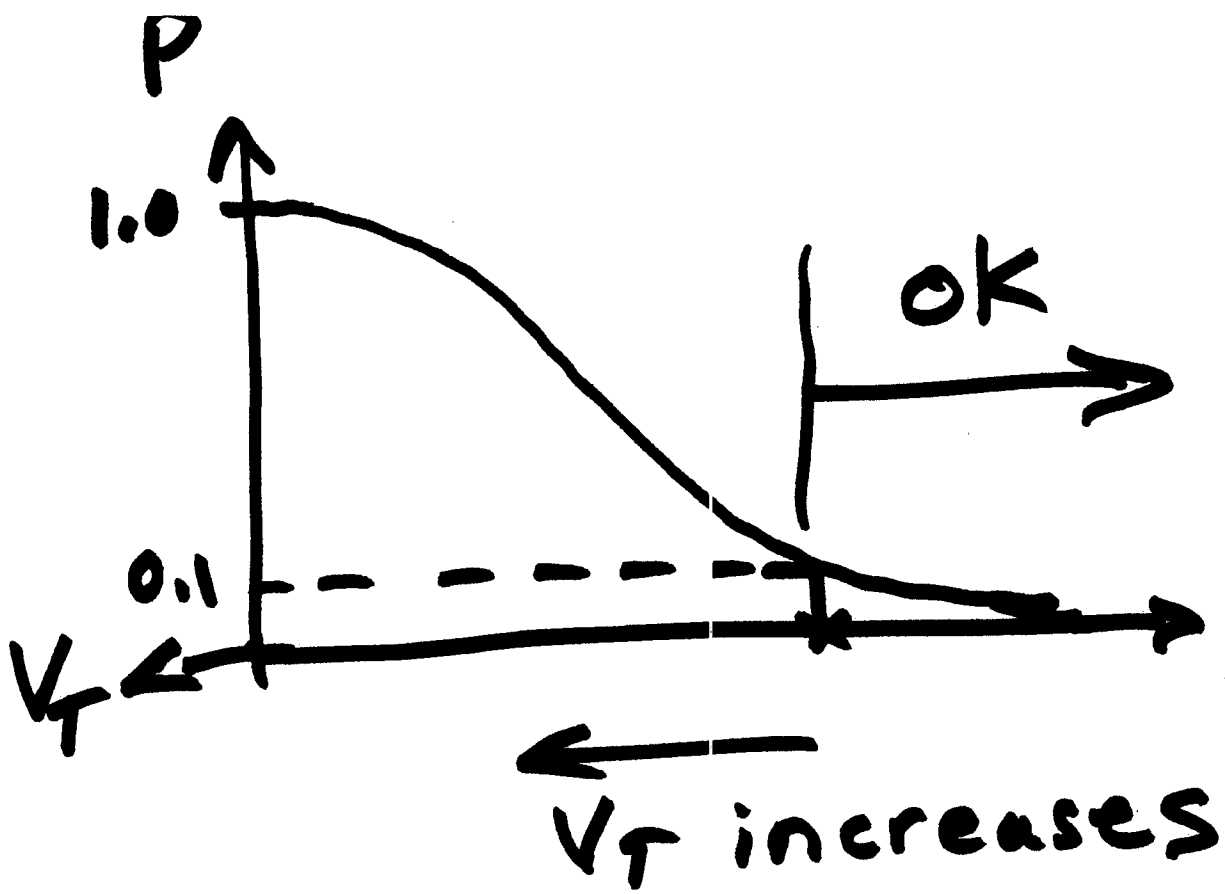


$V_{CFO} \Rightarrow .5$ prob of flashover



Norm Rand Var:

$$z = \frac{VT - V_{CFO}}{\sigma_{VT}}$$



Statistics:

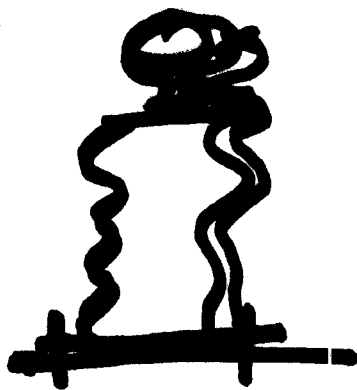
- Depends on V-waveform
- Test-to-test conditions
 - Physical Changes
 - Humidity ←

-
- Avalanche Breakdown
 - Statistic Variations
 - "Formative time lag"

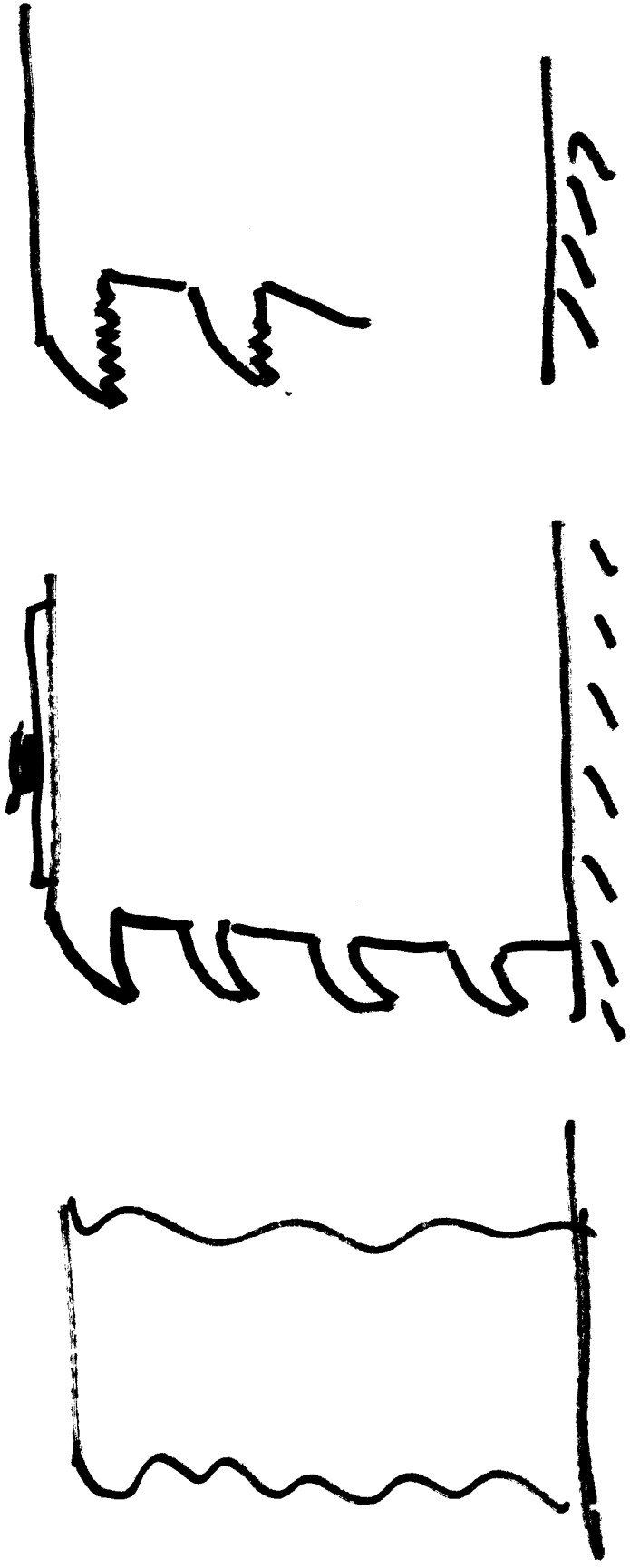
Sparkover: Gap $\circ \rightarrow \circ$

Flashover: tracks surface

"Creep distance"



- dust
- smog
- salt



High Creepage Distance.