

Topics for Today:

- Course Info:
 - Web page: <https://pages.mtu.edu/~bamork/ee5200/>
 - 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)
- HW#9 - Probs. 9.2, 9.3, 9.4 due Tues Mar 26th, 9am.
- Mid-term: Apr ~6-11th time window. Discuss options.
- Term Project - choose key journal paper, begin review of journal paper.
- Transformer modeling - Section 11.1 of text, plus lecture notes
 - Magnetic materials: B-H characteristics
 - Transformer Inrush - initial conditions
 - Energization inrush
 - Recovery inrush
 - Sympathetic inrush
- Next - take stock of available ATP transformer models

ATP Pointers: Surge sources

The type 15 surge source is quite adaptable. For example, in Prob. 9.3, you need a surge voltage $v(t) = 800 e^{-25,000t}$. However, the surge function is a double exponential, so how can you use it? Answer: $v(t) = 800 (e^{-25,000t} - e^{-1E12t})$ Volts,

i.e. make B a really really big negative number and the second exponential will decay almost instantly (during the first integration timestep) and from a practical point of view have no effect.

Component: SURGE

Attributes

DATA	UNIT	VALUE
Amplitude	Volt	800
A	1/s	-25000
B	1/s	-1E12
Tstart	s	0
Tstop	s	1000

NODE	PHASE	NAME
SU	1	XX0001

Copy Paste entire data grid Order: 0 Label:

Comment:

Type of source

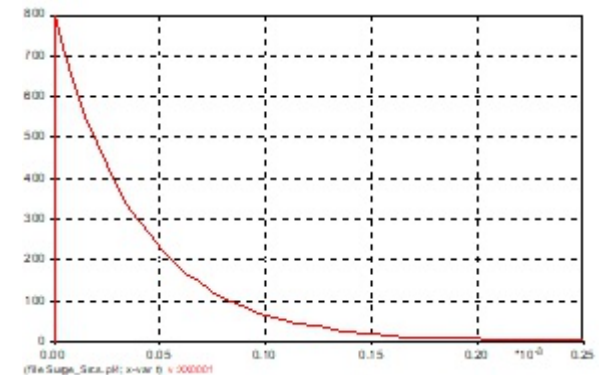
Current

Voltage

Hide

Lock

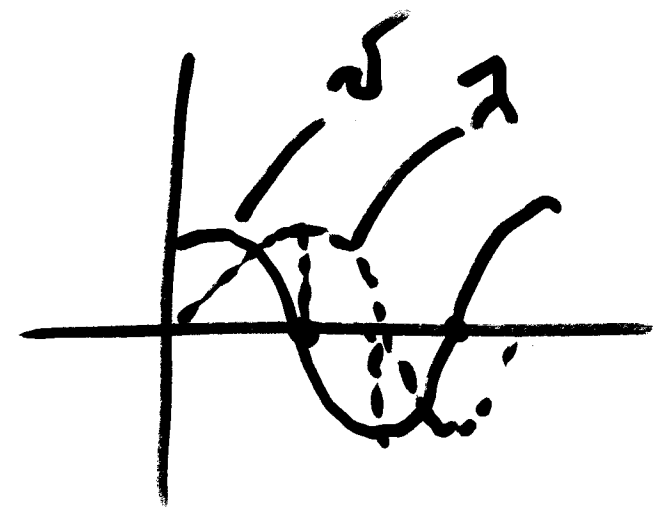
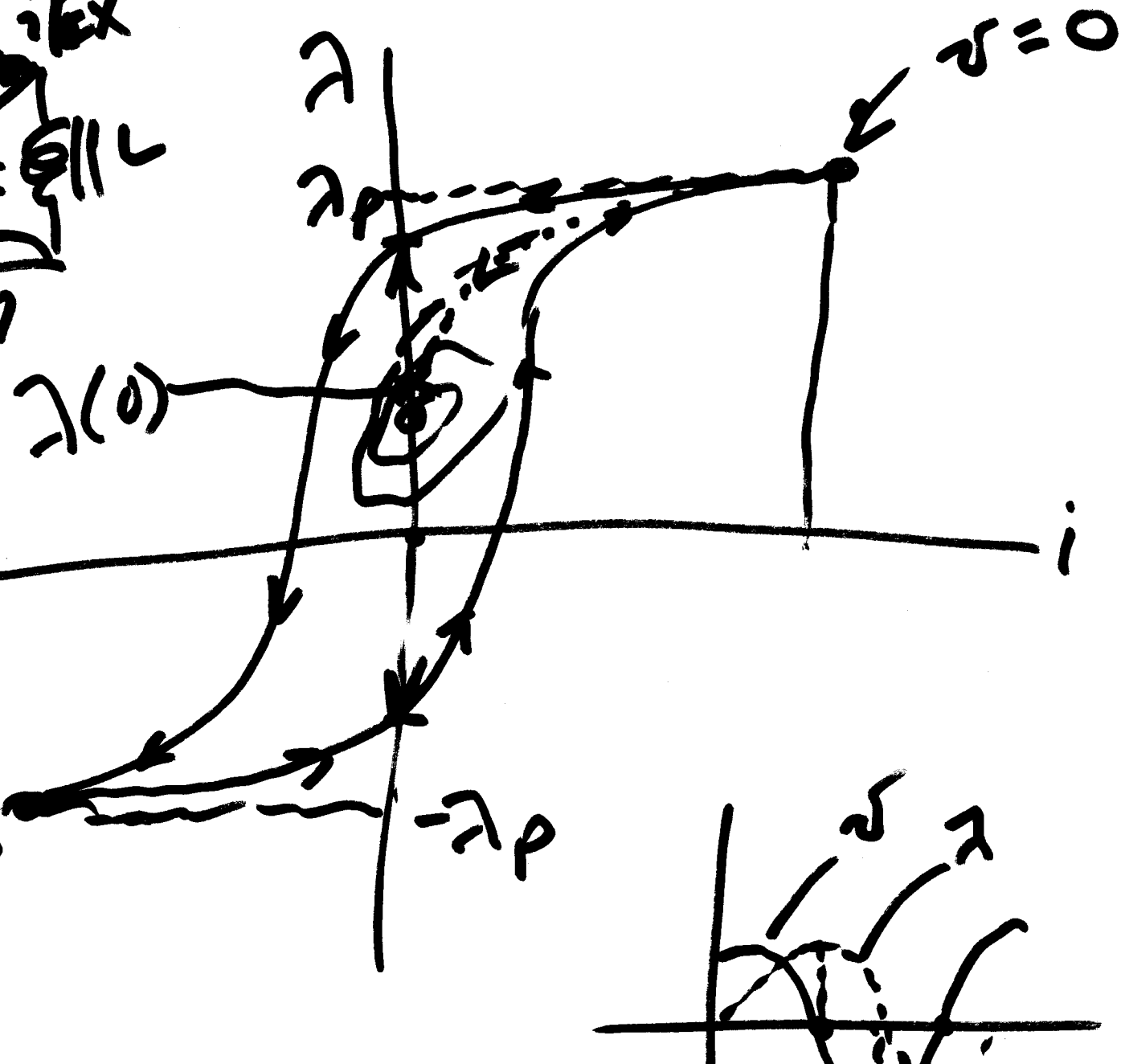
Edit definitions OK Cancel Help



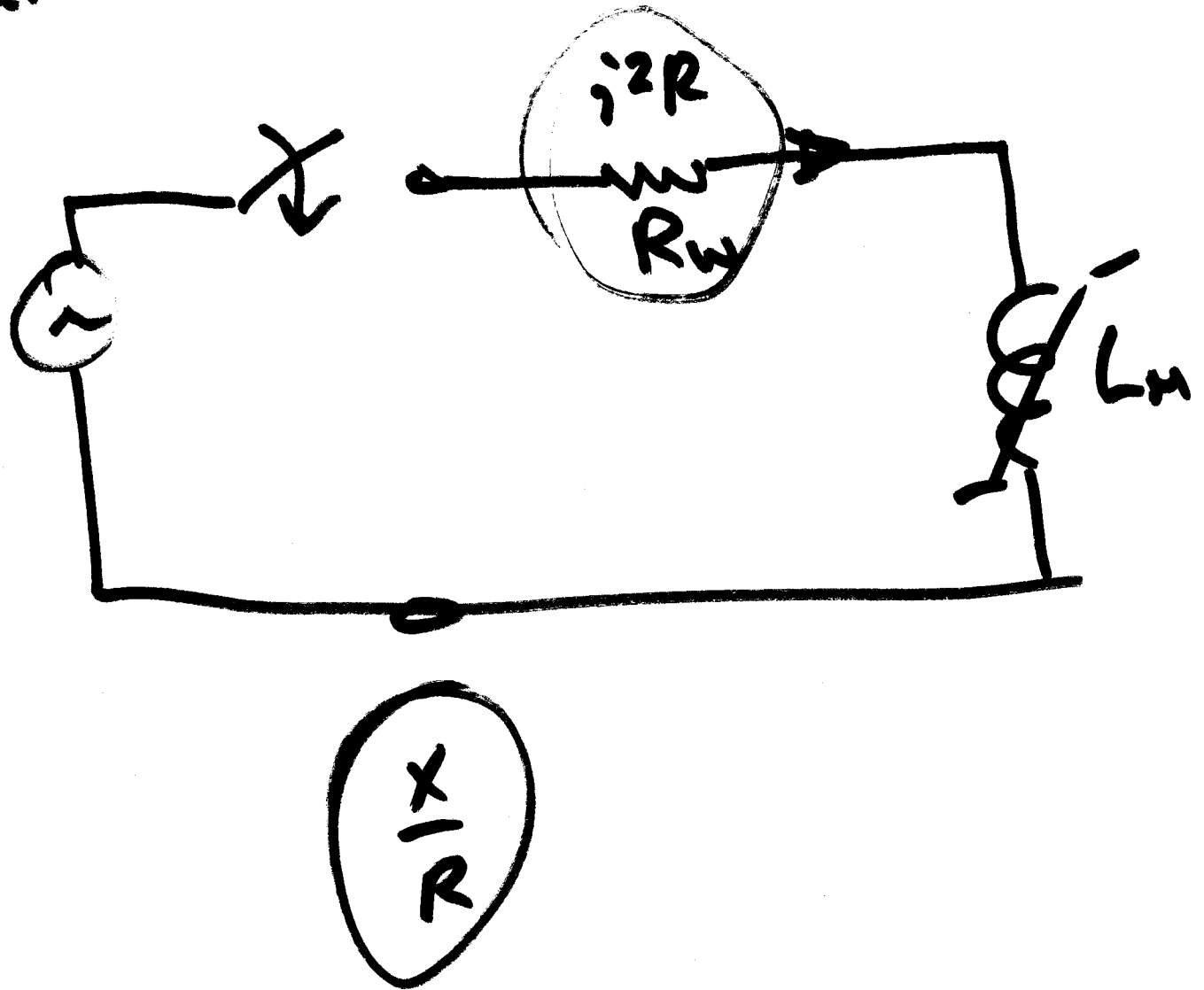
Important note: B is by default limited (by a data input filter) to min value of -1E6. Click on Edit definitions button, and change min allowable value of B to -1E12.



"Ringdown"
 $f = \frac{1}{2\pi\sqrt{LC}}$

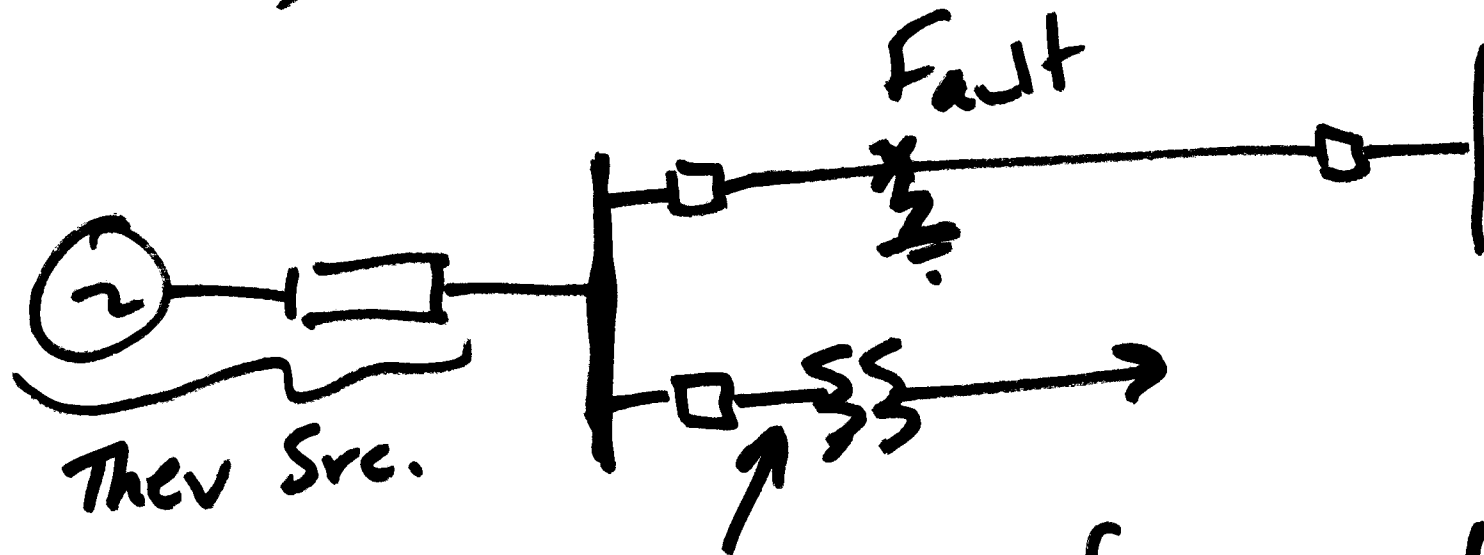


$$I_{ss \text{ peak}} = \frac{V_p}{\omega} = \frac{169}{377} = 0.45 \text{ A}$$



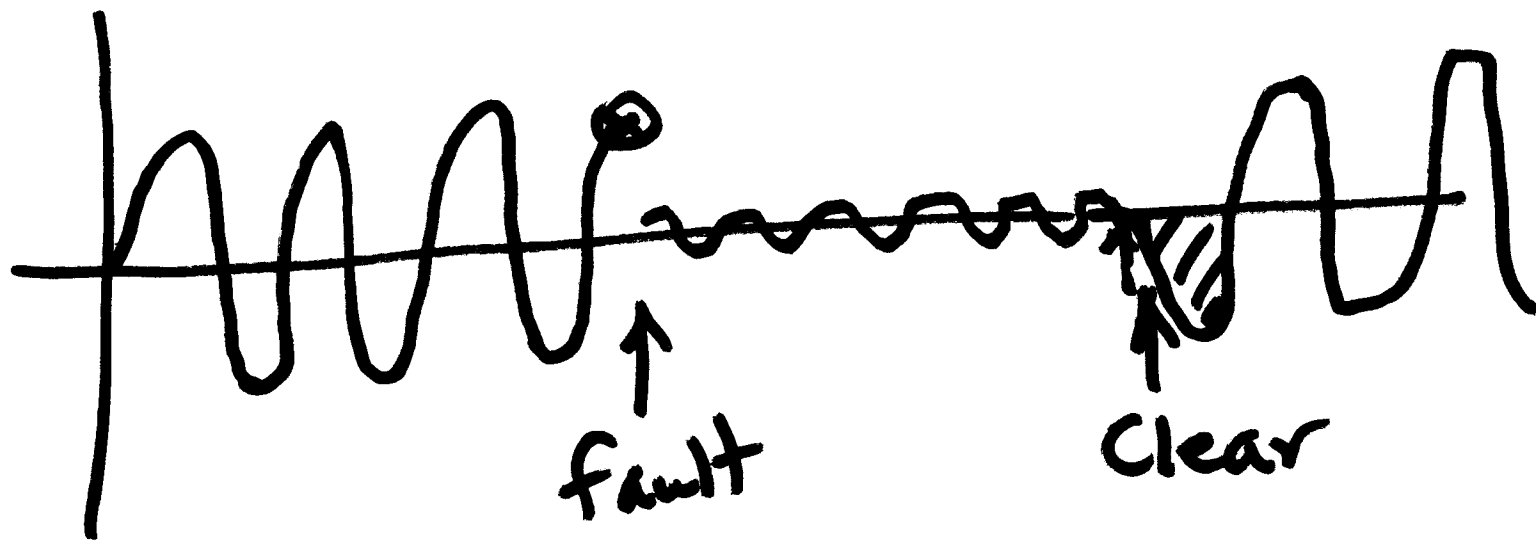
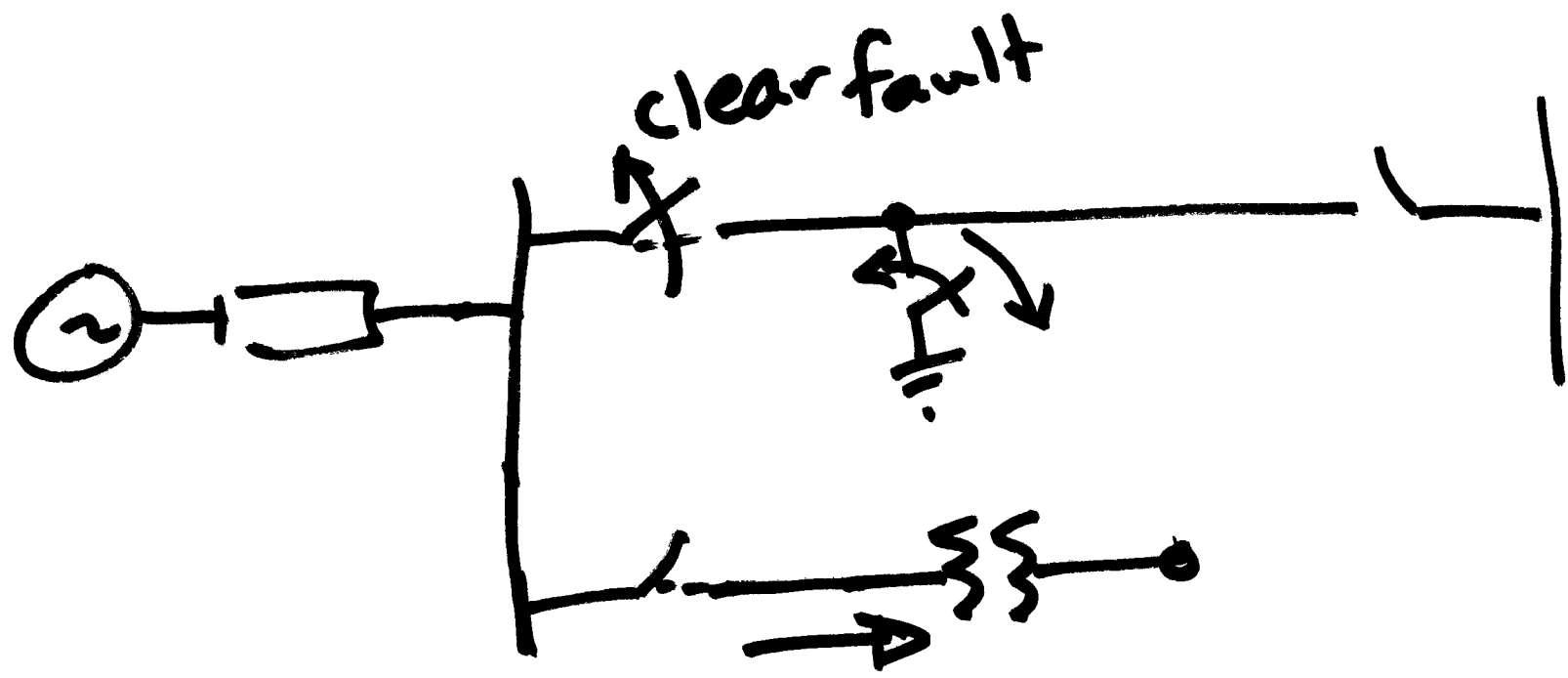
Energization Inrush ✓

Recovery Inrush

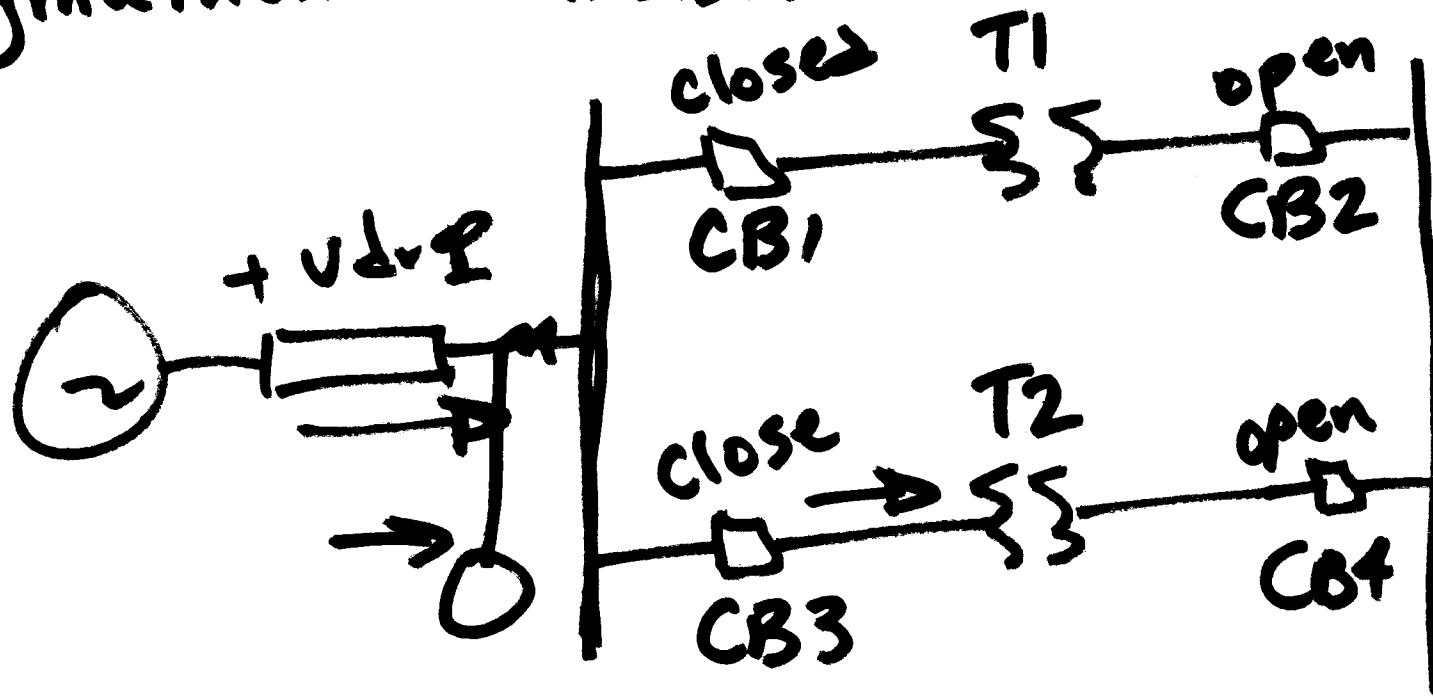


U at transformer, drops greatly during fault, U jumps back to normal very rapidly.

Like inrush, but from a depressed U up to normal U.



Symathetic Inrush -



Close CB3. Inrush to T2 causes a voltage drop at bus. Voltage to T1 is depressed due to inrush ~~to~~ to T2. V at bus "slowly" recovers and there can be a mild inrush to T1.

