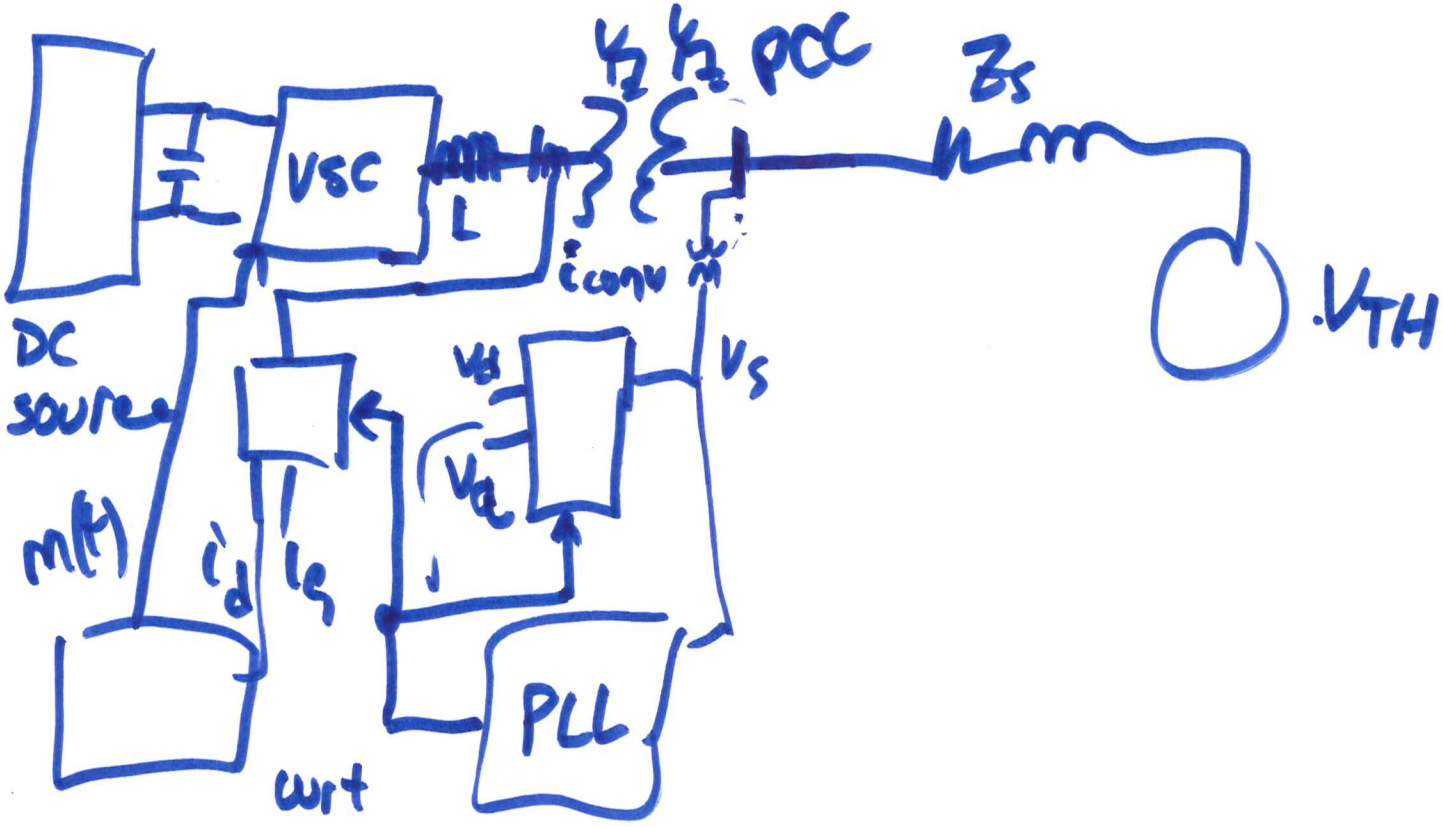
ECE 404-TD / 504-TD

ST: T&D APPLICATIONS OF VOLTAGE SOURCE CONVERTERS

SESSION no. 43

- current control in response to external faults



If there is a fault on ac system beyond the PCC

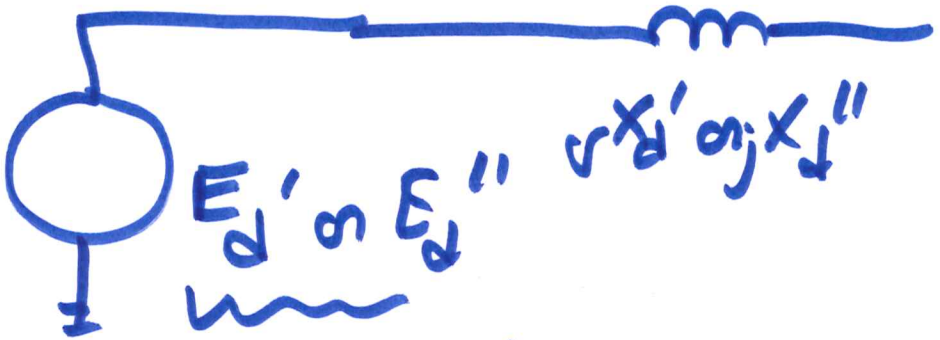
- V_s will be reduced on faulted phase (or phases)
- V_s will exhibit unbalance if fault is unbanced

Impact on control?

→ If stay with const P, Q

→ converter will increase currents to maintain P, Q

- will not behave like a synchronous generator
  - not a fixed magnitude/angle internal source



- slowly time varying - stay at prefault value due to field constant

- Supply large currents
- angle of currents dictated by E' / Z_f

↖ impedance of fault path seen by the machine

Voltage source converter does not do this, in any normal control mode.

Converter can't supply large currents

- Problem with synch ref frame transform
  - → Negative sequence becomes 120 Hz oscillation in V_d, V_q

converter control options/challenges

challenge 1. maintaining synchronism

→ PLL uses synch ref frame transformation & PI control

→ regulate $V_{sq} \to 0$ and determine w.r.t of system

unbalanced fault

negative sequence voltage maps to 120Hz

→ PLL need filter to block 120Hz in transformed domain (8.3.5)

2. Need to do some form of current regulation that does not directly respond to maintaining constant P & pf ($Q = 0$)

3. Grid codes require Low Voltage ride through → converter control could be designed to supply reactive power

regulate |V| at PCC or fixed leading P.f

4. Current regulation options

(A) I_d, I_q based ?

- could have some unbalance in output
- some ripple at 120Hz

(B) current regulated PWM to guarantee balanced currents (balanced references)

→ balanced currents better
for dc bus voltage ripple