ECE 529
Utility Applications of Power Electronics

Session 25
**Midterm Exam**

- Mixture of short answer questions
- Some problems/simulation
- Possible time window
  - March 26 - April 15
    - Choose 3 day period
      - Email me with day/time to start.
- Discuss next time
VSC current regulators

\[ P = \frac{3}{2} \left( V_{dID} + V_{qEQ} + V_{vQ} \right) \]

Open loop \( P_{\text{REF}} \rightarrow I_{\text{DREF}} \)

Option 2

Depend on Park's Transform
Similar for $Q_{REF} \rightarrow I_{QREF}$

3. DC Power Pole to Determine either $P_{REF}$ or $I_{DREF}$ (Section 8.6)

- DC current source
- Another VSC or DC/DC converter or PV array
- V$\text{DC}_{\text{meas}}$
- CTRL
- V$\text{DC}_{\text{meas}}$
- $P_{\text{POI}}$
- $P_{3\theta}$ at POI
**Option 1** (Energy balance) \[ E_{cp} = \frac{1}{2} CV^2 \]

\[(V_{denv}) \rightarrow (V_{DC, meas}) \rightarrow \text{PI} \rightarrow \text{Pnleb} \rightarrow \frac{1}{\frac{1}{3}} \rightarrow I_{Dnleb} \]

\[\text{or other function} \]

**Option 2**

\[V_{denv} \rightarrow V_{DC} \rightarrow \text{PI} \rightarrow I_{Dnleb} \rightarrow I_{Dmeas} \]
Vdc and |Vac| controllers

- Modified Power System
**Vdc and |Vac| controllers**

- Modified Power System

- DC load change:

\[ 83.404 \times 1200V = 1 \text{ kW} \]
- Controlling Vdc (ATPDraw implementation)

\[
E = \frac{1}{2} CV^2
\]

\[
1868 \cdot \left( \frac{19 + s}{2017s + s^2} \right)
\]

Log due to current controller response

Step change in \( I_{dc} \)

\( P_{30} \quad \text{Pref} \)
- DC voltage in response

**PSCAD/EMTDC**

Modified DC link:
old Power ref control
Change in real power leads to change in reactive power:

V_{Ac} measured

V_{ph} in at point of common coupling (PCC) because PLL regulated

V_{sq} to 0
- AC voltage transient due to step change in real power