Topics for Today:

- Questions?
- Questions/Comments on Homework #4?
- Loadflow Formulation: “NR Details” handout (Week 4)
- NR Algorithm implementation.
- LU Factorization (needed for each iteration) \[ \text{in situ} \]
- Reordering \[ [A][V] = [S] \]

Coming up:

- More MatLab - build Jacobian, solve for \( \Delta \delta \) and \( \Delta V \), iterate.
- Data structures, more on reordering to avoid zero divides and/or speed up solution.
MatLab - Compiler vs. Interpreter?

- C++
- Fortran

Hybrid Environment:
- C++, Fortran, Pascal/Delphi,
- Java, C, etc.

Make .obj & link

Matlab

Binary .exe

F90, F95, F2000

Warning...

Iterations, nested loops, etc. can be very slow!

Make use of vector operations!

Key: Data should be passing
**Flat Start:** All \( V \) at PQ (Load) buses are set to 1.0 pu. All \( S \) at PQ buses set to 0°.

**Hot Start:** Use \( V \) values from a similar case that converged.

<table>
<thead>
<tr>
<th></th>
<th>Flat</th>
<th>Hot</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQ (Load)</td>
<td>(</td>
<td>V</td>
</tr>
<tr>
<td>PV (GEN)</td>
<td>(</td>
<td>V</td>
</tr>
</tbody>
</table>
Filling Jacobian:

Bus 2: PQ
Bus 3: PV
Bus 4: PQ

For N buses:

- N-1: S's to solve for
- N-1 - NGen: V's to solve for

\[
\begin{bmatrix}
\frac{\partial P}{\partial S_1} & \frac{\partial P}{\partial S_2} & \ldots \\
\frac{\partial Q}{\partial S_1} & \frac{\partial Q}{\partial S_2} & \ldots \\
\end{bmatrix}
\]
\[
\begin{cases}
\text{If } B\text{NUM} > N\text{SLACK} \\
\quad \text{Row} = B\text{NUM} - 1 \\
\text{ELSE} \\
\quad \text{Row} = B\text{NUM} \\
\text{END}
\end{cases}
\]

Row = INT value of row in \([J]\) that \(\frac{2P_4}{\delta} \) go into.

Row = NDDst? 

Row 19

\[
\begin{bmatrix}
2 & 3 & \cdots & 5 & 7 & \cdots & 14 \\
\vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\
28 & 8 & \cdots & 8 & 8 & \cdots & 8
\end{bmatrix}
\]
For a given bus:

Bus 4: PQ

What row in [J] do \( \frac{\partial P_4}{\partial x} \) go in?

\[
\begin{bmatrix}
\Delta s_2 \\
\Delta s_3 \\
\Delta s_4 \\
\end{bmatrix}
\]

Answer: row \( 3 = \frac{\text{Num}}{-1} \)

If slack bus is 1.

IF&
Good place to start: \( \Delta \delta \Delta V \) vector

\[
[J][\Delta \delta] = [\Delta P]
\]

- Missing (on purpose)
- \( \Delta V \) at all PV buses
- \( \Delta \delta, \Delta V \) at slack bus.
Gen Buses: $2, 3, 6, 8 - 4$

Total Buses: 14

Swing/Slack: 1 (only one)

Size of $[\Delta S \Delta V]$ vector:

$=(NBus-1) \times 2 - NPV = 22$

initialize $\Delta \Delta \Delta \Delta V$

$NDGs = (NBus-1)$

$NDVs = (NBus-1 - NPV)$