EE 5240 - Lecture 12 Wed Feb 6, 2019

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)
- Reordering

Coming up:

- More MatLab - build Jacobian, solve for $\Delta\delta$ and ΔV, iterate.
- Data structures, more on reordering to avoid zero divides and/or speed up solution.

MatLab - Compiler vs. MatLab interpreter?

↓

Binary .exe

↓

text → function, operator

SLOW!

- C++
- Fortran
  - F90, F95, F2000

Warning...

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

Hybrid Environment:

C++, Fortran, Pascal/Delphi, Java, G, etc.

Make .obj & link

← Key: Data ~ passing structu

Use Vector Operations!

Flat Start: All $|V|$ at PQ (LOAD) buses are set to 1.0 pu.
All δs at PQ buses set to 0°.

Hot Start: Use $\tilde{V}$ values from a similar case that converged.

	Flat	Hot
PQ (LOAD)	$\|V\| = 1.0$ pu. $\delta° = 0°$	Copy converged similar case
PV (GEN)	$\|V\|$ = Fixed $\delta° = 0°$	$\|V\|$ = Fixed $\delta°$: Copy similar case

Filling Jacobian:

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

For N buses:

- N-1: δ's to solve for
- N-1-NGen: V's to Solve for.

$$\begin{bmatrix} \frac{\partial P}{\partial \delta} & \frac{\partial P}{\partial V} \\ \frac{\partial Q}{\partial \delta} & \frac{\partial Q}{\partial V} \end{bmatrix} \begin{bmatrix} \Delta \delta \\ \cdots \\ \Delta V \end{bmatrix} = \begin{bmatrix} \Delta P \\ \cdots \\ \Delta Q \end{bmatrix}$$

J

$$\begin{bmatrix} \frac{\partial P_2}{\partial \delta_2} & \frac{\partial P_2}{\partial \delta_3} & \cdots \end{bmatrix}$$

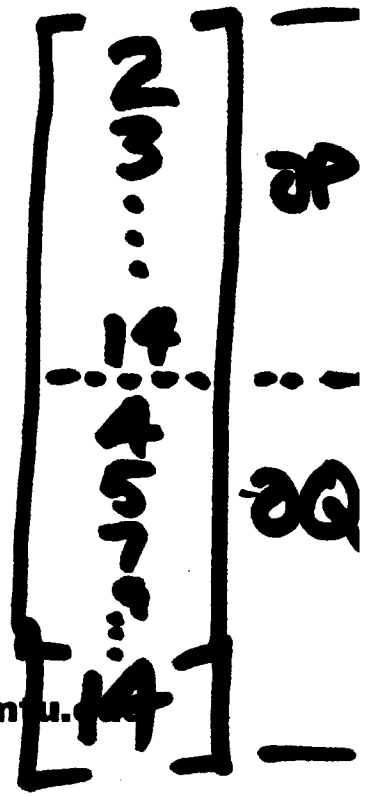
```
If BNUM > NSLACK
    ROW = BNUM - 1
ELSE
    ROW = BNUM
END
```

ROW = INT value of row in [J] that $\frac{\partial P_4}{\partial \_}$ go into.

How about $\frac{\partial Q}{\partial \_}$ ROW?

Row 14

ROW = NDdst



For a given bus:

Bus 4 : PQ

What row in [J] do $\frac{\partial P_4}{\partial \_}$ go in?

Answer: row 3 = [redacted] - 1

If slack bus is 1.

$$\begin{bmatrix} \Delta\delta_2 \\ \Delta\delta_3 \\ \Delta\delta_4 \leftarrow \\ \\ \\ \end{bmatrix}$$

IF δ

Good place to start: $\Delta\delta$ ΔV vector

$$\begin{bmatrix} J \end{bmatrix} \begin{bmatrix} \Delta\delta \\ \Delta V \end{bmatrix} = \begin{bmatrix} \Delta P \\ \Delta Q \end{bmatrix}$$

$$\begin{bmatrix} \Delta\delta_2 \\ \Delta\delta_3 \\ \Delta\delta_4 \\ \vdots \\ \Delta\delta_N \\ \hline \Delta V_2 \\ \Delta V_4 \\ \vdots \\ \Delta V_N \end{bmatrix}$$

← Missing (on purpose)

- ΔV at all PV buses
- $\Delta\delta$, ΔV at slack bus.

Gen Buses: 2, 3, 6, 8 — (4)

Total Buses: 14

Swing/Slack: 1 (only one)

Size of [Δδ ΔV] vector:

$= \underbrace{(NBus-1)*\#2 - NPV}_{\text{initialize DdDv}} = 22$

NDδs = (NBus-1)

NDVs = (NBus-1-NPV)