

SAARC Training Workshop 'Power System Studies for Synchronization of Multiple Systems'

Convergence Problems

Day-1-H

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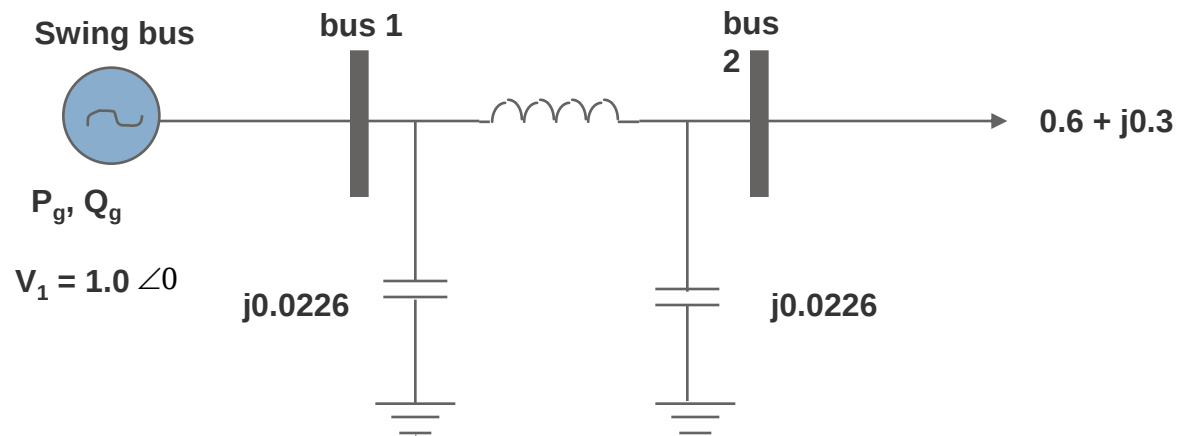


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Some reasons for Load Flow Divergence

- Poor initial voltage estimates.
- Network has high R/X ratios.
- Certain combinations of branch impedances (e.g network has many series capacitors).
- Overloading has produced reactive power problems.

Numerical Example



- Form the admittance matrix
- Solve for voltage at bus (V_2) , angle at bus 2, P_{g_1} and Q_{g_1} using:
 - Gauss Seidel method for 2 iterations
 - DC load flow method
 - Newton Raphson technique

CASE NON CONVERGENCE

- After preparing a case if it does not solve (blows up) then data problems may have caused this.
- Check for rogue entries :
 - Gshunt & Bshunt data on buses
 - LineG & LineB data on branches.
- Check transformers Winding angles (phase shift angles) are all the same to each lower voltage level.
- Check generators controlling the same bus all have the same target voltage.

CASE NON CONVERGENCE (cont.)

- Check for low and zero impedance branches – add some impedance (X) to see if it resolves the problem.
- Look for transformers in series – i.e. Transformer from A to B (controlling B voltage) and transformer from B to C (controlling C voltage) – these can suffer "tap run-away" - fix the taps on one of them at a normal value (about 1.0 pu).
- Similarly check for generators controlling the low voltage side of a transformer that is controlling its HV voltage – fix the transformer taps or change the modelling (e.g. gen control HV, transformer control LV).

CASE NON CONVERGENCE (cont.)

- Check for generation with unrealistic MVAR ranges – correct them.
- If the network parameters have been entered correctly then we should be able to find a solution ...

SOLVING THE CASE

- Of the loadflow solutions, the Modified Gauss Siedel (in the Gauss tab from the Powerflow -> Solution -> Solve.. menu) is the least likely to blow up .
- If the case has already blown up use a FLAT start.
- Don't adjust taps for the first run.
- If it still blows up try ignoring the VAR limits .
- A Gauss Siedel should bring the mismatch below 500MVA for a typical system – then use Newton solutions.

SOLVING THE CASE (cont.)

- Of the Newton loadflow solutions, (in the Newton tab from the Powerflow -> Solution -> Solve.. menu), the Fixed slope Decoupled Newton Raphson is the least likely to blow up .
- Don't adjust taps for the first run, set VAR limits to Apply Immediately.
- If it still blows up – re-load the Gauss Siedel solution and try ignoring the VAR limits.
- A Newton should bring the mismatch below 5 MVA for a typical system.
- When it has converged – save it !! – then try solving again letting the Taps adjust automatically.

SOLVING THE CASE (cont.)

- If the case will only solve with VAR limits ignored then :
Look at a listing of the generators in the case – identify the ones where Q has exceeded the Q limits – this gives you the areas in the network to focus on first.
- Look at the worst mismatches reported in the case.
Check these buses for any unusual data (particularly low impedance branches).
- Look at the blown up solution in the progress window – identify the bus where the first large mismatch occurred – check this bus.