Power flow solution using Gauss Seidel method

Algorithm of Gauss seidal method

Step1: Assume all bus voltage be 1+ j0 except slack bus. The voltage of the slack bus is a constant voltage and it is not modified at any iteration

Step 2: Assume a suitable value for specified change in bus voltage which is used to compare the actual change in bus voltage between K th and (K+1) th iteration

Step 3: Set iteration count K = 0 and the corresponding voltages are V10, V20, V30 … Vn0 except slack bus

Step 4: Set bus count P = 1

Step 5: Check for slack bus. It is a slack bus then goes to step 12 otherwise go to next step

Step 6: Check for generator bus. If it is a generator bus go to next step. Otherwise go to step 9

Step 7: Set │VPK│= │VP│ specified and phase of │VPK│ as the K th iteration value if the bus P is a generator bus where │VP│ specified is the specified magnitude of voltage for bus P. Calculate reactive power rating P-1 n QP K+1 Cal = (-1) Imag [(VPK)A (Σ Y pqVq k+1 +Σ Y pqVq K q=1 q =P

Step 8: If calculated reactive power is within the specified limits then consider the bus as generator bus and then set QP = QP K+1 Cal for this iteration go to step 10

Step 9: If the calculated reactive power violates the specified limit for reactive power then treat this bus as load bus.

If QP K+1 Cal < QP min then QP = QP min

QP K+1 Cal > QP max then QP = QP max

Step10: For generator bus the magnitude of voltagedoes not change and so for all iterations the magnitude of bus voltage is the specified value. The phase of the bus voltage can be calculated using

VPK+1 temp = 1 / YPP [(PP –jQP / VPK *) - ΣYpqVqK+1 - ΣYpqVqK]

Step 11: For load bus the (k+1)th iteration value of load bus P voltage VPK+1 can be calculated using VPK+1 temp = 1 / YPP [(PP –jQP / VPK *) - ΣYpqVqK+1 - ΣYpqVqK]

Step 12: An acceleration factor α can be used for faster convergence. If acceleration factor is specified then modify the (K+1)th iteration value of bus P using

VPaccK+1 = VPK + α (VPK+1 – VPK) then Set VPK+1 = VPaccK+1

Step 13: Calculate the change in bus-P voltage using the relation

Δ VPK+1 = VPK+1 -VPK

Step 14: Repeat step 5 to 12 until all the bus voltages have been calculated. For this increment the bus count by 1 go to step 5 until the bus count is n

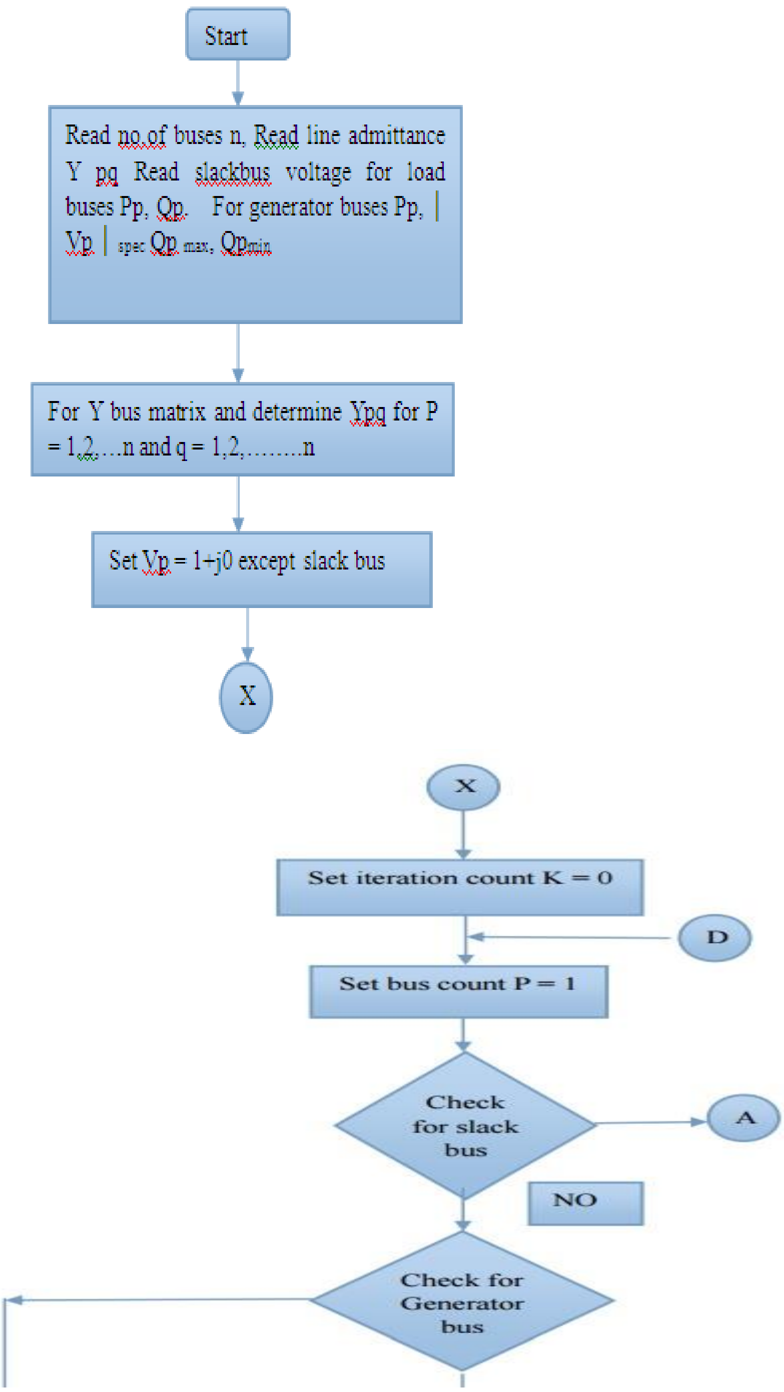
Step 15: Find the largest of the absolute value of the change in voltage

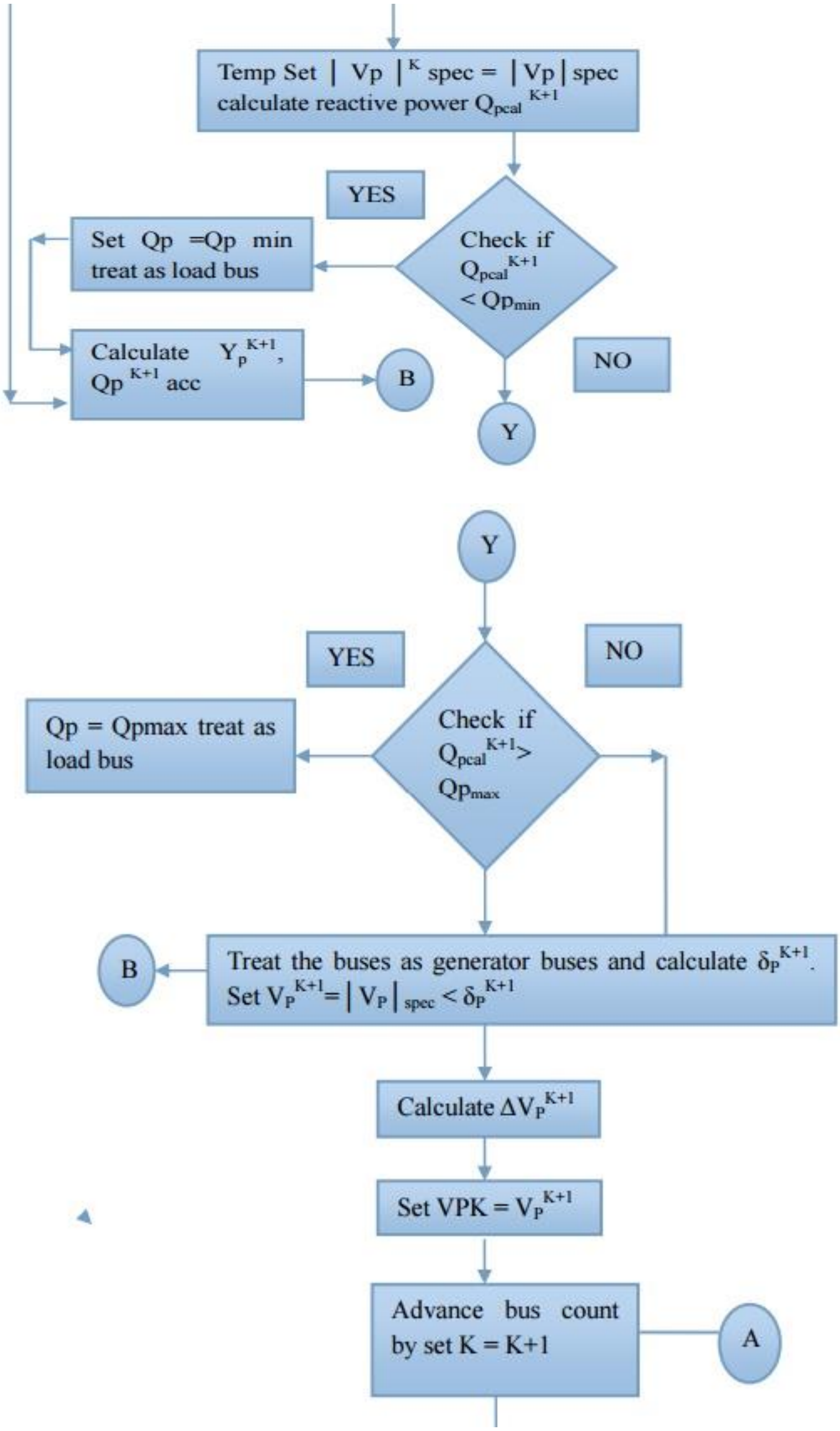
│ΔV1K+1│, │ΔV2K+1│, │ΔV3K+1│, ……………│ΔVnK+1│

Let this largest value be the │ΔVmax│. Check this largest change │ΔVmax│ is less than pre specified tolerance. If │ΔVmax│ is less go to next step. Otherwise increment the iteration count and go to step 4

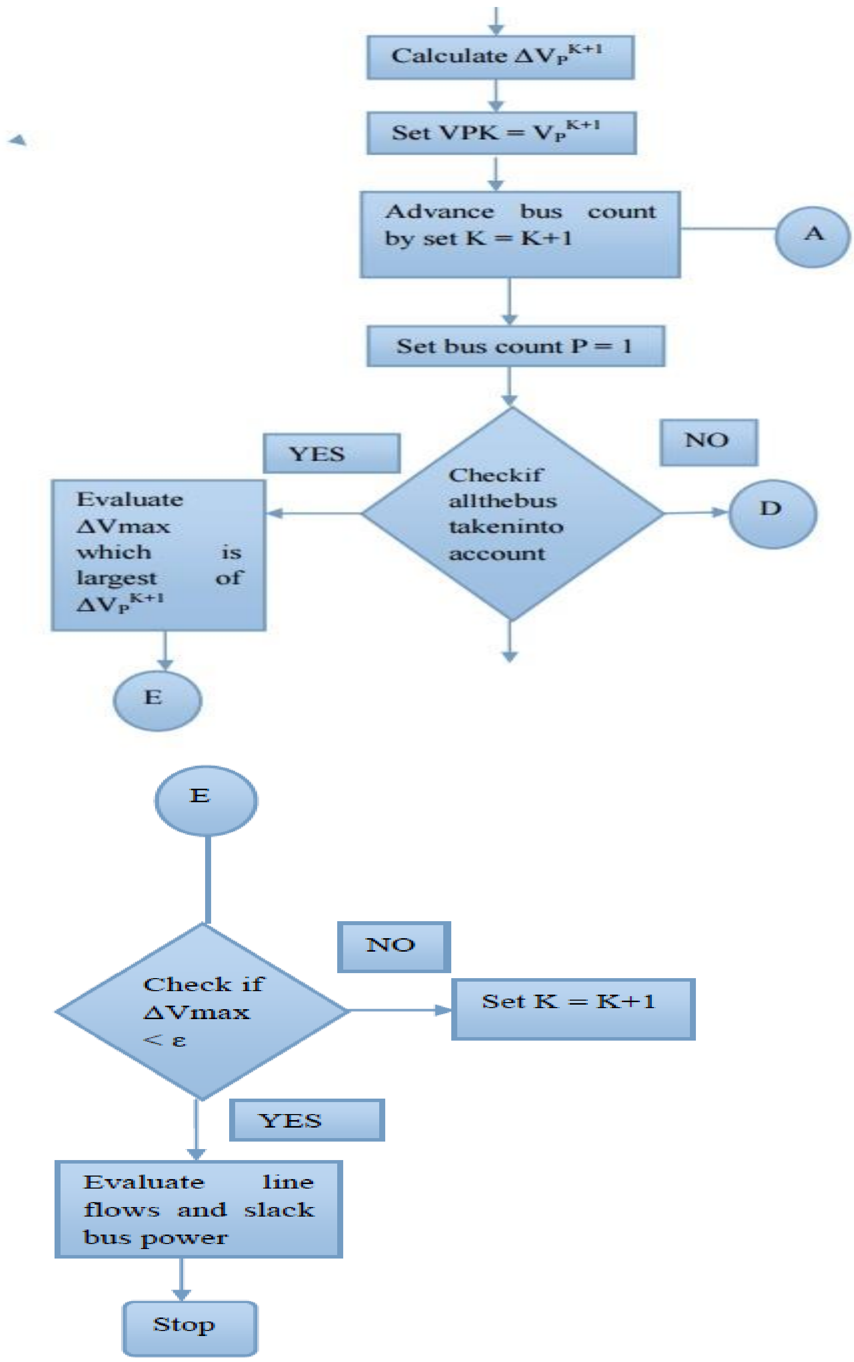
Step 16: Calculate the line flows and slack bus power by using the bus voltages.

Gauss - Seidal method flow chart





Temp Set | Vp |K spec = | Vp | spec
calculate reactive power Qpcal K+1
YES
Check if Qpcal K+1 < Qpmin
Set Qp =Qp min treat as load bus
Calculate Yp K+1, Qp K+1 acc
B
NO
Y
Y
YES
NO
Qp = Qpmax treat as load bus
Check if Qpcal K+1 > Qpmax
Treat the buses as generator buses and calculate δP K+1. Set VP K+1 = | VP | spec < δP K+1
B
Calculate ΔVP K+1
Set VPK = VP K+1
Advance bus count by set K = K+1
A



Advantages and disadvantages of Gauss-Seidel method

Advantages:

- Calculations are simple and so the programming task is lessees.
- The memory requirement is less.
- Useful for small systems

Disadvantages:

- Requires large no. of iterations to reach converge.
- Not suitable for large systems.
- Convergence time increases with size of the system