5.3 Power Flow Analysis

Newton-Raphson Solution Algorithm

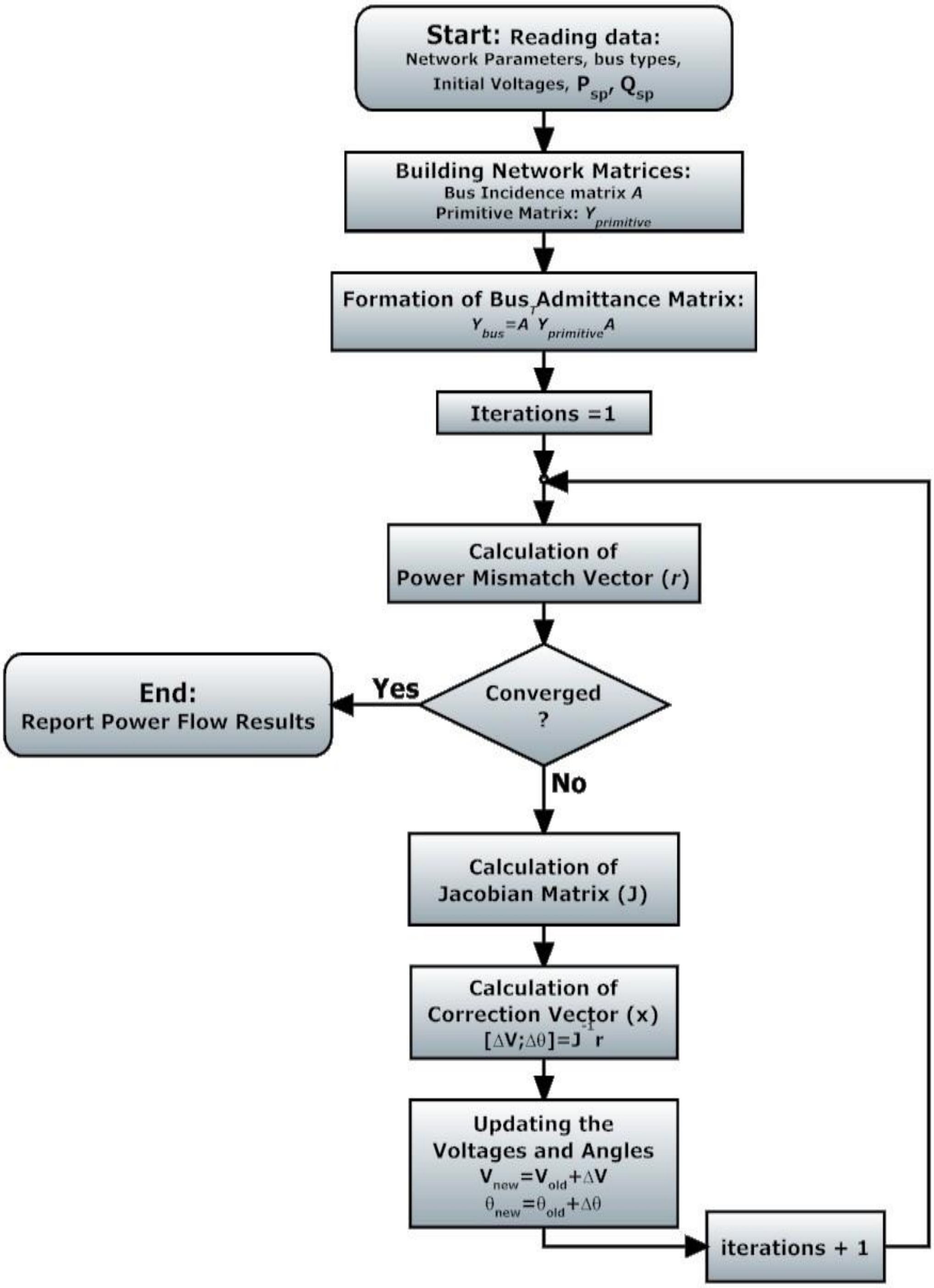

Figure 5.3.1 Newton Rapson Solution flow chart

[Source: "HVDC Power Transmission Systems" by K.P.Padiyar, page-84]

HVDC Load Flow Solution Method

High Voltage Direct Current (HVDC) transmission is important for long distance, underground, and submarine transmission. Due to the increasing strains on existing systems, it is necessary to develop a better method for performing the load flow analysis of an integrated HVDC power system. However, the power flow has to be substantially enhanced to be capable of modeling the operating state of the combined AC and DC systems, and this must be done fast and efficiently under the specified conditions of load generation and DC system control strategies. The development of an enhanced HVDC-load flow system based on the Newton - Raphson method is the focus of this chapter. The variation of the DC link chosen for the problem formulation are: (1) the converter, terminal DC voltage; (2) the real and imaginary components of the transformer secondary current; (3) converting transformer tap ratios; (4) the firing angle of the rectifier; and (5) the current in the DC link.The equations relating these five variables and their solution strategy are discussed. As the model developed is independent of a particular control mode of the DC link, the AC and DC link equations are solved separately and thus the integration into a standard load flow program is possible without significant modifications of the AC load flow algorithm. In the AC system iterations, each converter is designed as a complex power load at the AC terminal bus bar, and the DC link equations are solved using the most recent value of the AC bus bar voltage. The AC and DC system equations are solved simultaneously