ABSTRACT

The objectives of the work described in this thesis are:

(a) to study and evaluate recent trends in the piecewise solution of power system load flow and (b) to contribute, if possible, to the advancement of the field of piecewise load flow in certain aspects of the problem where further development seems to be justified.

The diakoptics equations are deduced from a new approach based on algebraic manipulation and the technique of superposition in a conceptually simpler manner. The technique of superposition has been singled out for primary attention in view of its ability :

(i) to yield diakoptics equations from algebraic manipulation ;

(ii) to provide clear insight into the diakoptics equations ;

(iii) to take into account the inter-subdivisional level model ;

(iv) to make possible the selection of one reference node in each subdivision ;

and (v) to yield a new, completely generalized and exact method independent of load flow techniques, for computation of cutline currents and reference voltages.

The performance of the popular decomposition techniques with reference to admittance representation of power system is evaluated from several view points with emphasis on their ability to conserve computer core locations and minimise solution time. Effect of acceleration factors, number of subdivisions and number of lines or nodes involved in tearing is investigated. Correlation has been established between decomposition techniques, culminating in the recognition of the fact that topological decompositions can be accomplished by the algebraic manipulation of the original network equations.

An algorithm to the piecewise load flow solution by Newton-Raphson method using Sasson's decomposition technique (SDT) is developed. The performance and the limitations of this approach are investigated and the superiority of SDT established.

A new, completely generalized, exact, reliable and fast piecewise method for computation of cutline currents and reference voltages, independent of solution techniques, has been developed. Performance of this method in conjunction with Newton-Raphson and Gauss-Seidel solution techniques is investigated. The proposed approach is shown to be superior to the existing methods.

Finally, the idea of piecewise solution has been extended to the formation of bus impedance matrix. The piecewise method is described and tested, and, based on extensive numerical experiments on a number of power systems, its superiority in terms of speed and computer storage requirement is established.