# ABSTRACT

Distributed generations (DGs) are playing major role in the modern power distribution systems to meet the ever growing demand of electricity and due to rapid depletion of fossil fuels. Integration of renewable energy based DG units with the conventional distribution systems not only improves the technical performance but also brings economical profits to the utilities. In the present thesis initially a combination of fuzzy multiobjective and genetic algorithm (GA) based approach is proposed for optimal shunt capacitor placement to improve the substation power factor value nearer to unity under different loading conditions. A GA based multiobjective based approach is proposed for obtaining optimal sizing of Distributed Generation (DG) units considering both technical and economical factors. The technical factors include real power loss reduction, line load reduction and voltage profile improvement, and the economical factors include optimum investments on DG units installation. For day time operation solar, wind and biomass DGs are considered and for night time operation biomass and wind systems are considered.

A simple sensitivity index based on voltage and loss sensitivity is proposed to identify optimal locations for the placement of DGs operating at unity power factor and shunt capacitors. Fuzzy GA based multiobjective approach is used for optimum sizing of DGs and shunt capacitors for improving the technical performance and voltage stability of the distribution system at peak load conditions. A two stage fuzzy multiobjective based heuristic algorithm is proposed for network reconfiguration of distribution systems considering distributed generations (DGs). For improving the transient response of the real power and frequency of the wind-diesel isolated power system under wind and load disturbance conditions robust D-stability based proportional - integral - derivative (P-I-D) controller is proposed. Simulation results are demonstrated to show the advantage of the proposed methodologies.



**Keywords:** Distributed Generation, Fuzzy Multiobjective approach, Genetic Algorithm, P-I-D Controller, Network Reconfiguration.