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A Survey On Optimization Technique For Congestion Managenment In Restrutured Power Market

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Abstract - *Power system congestion has become one of the most significant problems faced by system operators (SO) around the globe after the restructuring of the electricity industry. It creates hurdle in the smooth functioning of deregulated electricity market and causes an increased cost associated with it. So the investigation of congestion management techniques is of vital interest. This project presents a congestion management algorithm by optimally rescheduling the generator active power outputs. But all the generators in the system may not be taking part in the rescheduling process. Participating generators are optimally selected based on the generator sensitivities to power flow on congested lines. The algorithm manages congestion effectively ensuring minimum rescheduling cost of participating generators satisfying power balance, generator operating limits and line flow constraints. Algorithm is based on Particle Swarm Optimization (PSO) which minimizes the deviation between the rescheduled and scheduled generator power output levels.*

Key Words: **Particle swarm optimization, congestion, generator rescheduling, System operator.**

1. INTRODUCTION

Due to the restructuring of electricity industry there is a wide change in planning, operation and management of power system. Deregulation of electricity markets has a lot of advantages; however it made the electricity industry to face many unprecedented problems. Electricity market has some major complexities like lack of major storage capability, the just-in-time-manufacturing nature of electricity and the central role played by the transmission and distribution networks. The deregulated electricity industry introduces increased number of market participants, i.e. generation, transmission and distribution companies and so the number of transactions in the system will be more in number. A transaction means the energy transfer between two points in the power system. All the transactions depend on the transmission system as a means of transportation. In the conventional electricity market the utilities had control over the generation and transmission facilities. The current transmission system was designed long before and was not planned for the deregulation in the market. This causes congestion in the transmission system. The demand for electric power is increasing day by day and the utilities are increasing the generation in order to meet the demand. But the transmission lines have some limits in terms of thermal stability and voltage limits. When such limits are exceeded, the system is said to be congested and the system operator has to ensure that these limits are not exceeded. When there is congestion in the transmission system, all the desired transactions may not be realized. These unrealized transactions may cause additional costs in the system. Energy may not be able to purchase from the supplier who offers it at the lowest cost and the same amount of power has to be purchased from a different supplier at a higher cost. The situation is severe where the demand is more, supply is less and to keep the balance power has to be imported from the neighbouring systems. So the transmission congestion occurs at the tie lines. After some years of restructuring, operating rules and procedures are still constantly changing. The main effort lies in providing an effective market design for the restructured environment. One of the key requirements for the implementation of competitive markets is an effective management of congestion.

This paper mainly intended to present a technique for reducing the number of participating generators in rescheduling. It also optimally reschedules their real power outputs while managing congestion at minimum rescheduling cost. In a congested power system, the incremental or detrimental change in power outputs of all the generators may not equally affect the power transmitted on the congested line. So there is no need to reschedule the outputs of generators whose generations are less significant to the congested line flow. The sensitivities of the generators to the congested line are used to optimally select the participating generators. The second major purpose of this paper is to discuss the ability of particle swarm optimization algorithm in solving the congestion management problem.

1.1 Need of Optimization

In the restructured power system, the transmission stability limits violation results in the form of system imbalance in the system operation and controlling cost. Thus for stable system operation the system operator (SO) should manage the congestion in the transmission system. For congestion management, rescheduling of the generation is most efficient method. The generation rescheduling is done by using Particle Swarm optimization Technique.

2. Particle Swarm Optimization

Particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a candidate solution with regard to a given measure of quality. It solves a problem by having a population of candidate solutions, here dubbed particles, and moving these

particles around in the search-space according to simple mathematical formulae over the particle's position and velocity. Each particle's movement is influenced by its local best known position, but is also guided toward the best known positions in the search-space, which are updated as better positions are found by other particles. This is expected to move the swarm toward the best solutions. Algorithm for particle swarm optimization is as follow.

Step 1) Initialize the particle

Step 2) Calculate Fitness value for each particle

Step 3) If current fitness value is better than pbest, then we assign current fitness as new pbest and if current fitness value is not better then we keep previous pbest.

Step 4) Assign best particle pbest value to gbest.

Step 5) Calculate velocity for each particle.

Step 6) Updating data value. If target is reached then the algorithm stops, otherwise go to step 2.

The flow chart for the algorithm is given in fig.1

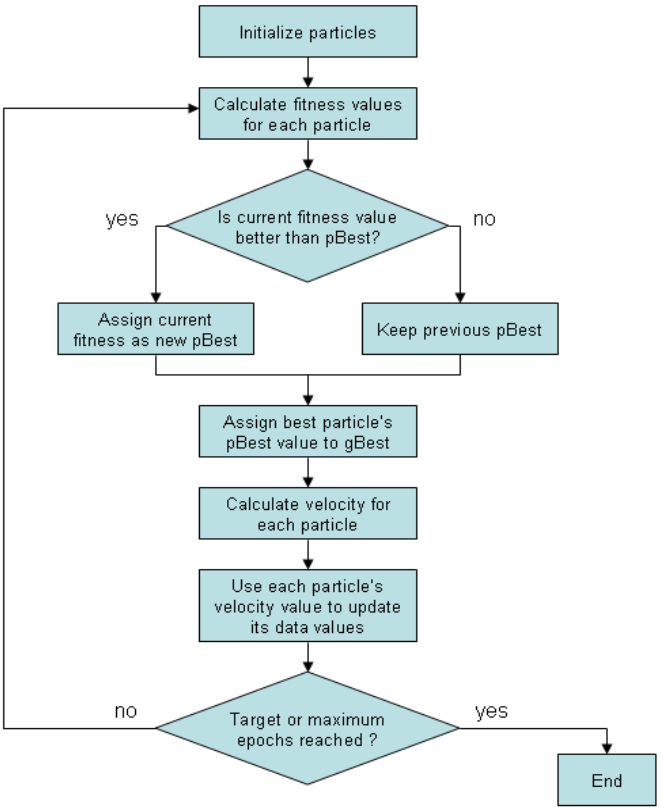

Fig -1:Flow Chart

3. Advantages of PSO

1) PSO is based on the intelligence. It can be applied into both scientific research and engineering use

2) The calculation in PSO is very simple.

3) It does not require derivatives.

4) Very Efficient global search algorithm.

5) Simple Implementation.

4. Conclusion

The paper concentrates on presenting a technique for optimum selection of generators for congestion management based on their sensitivities to the active power flow of thecongested.The optimization technique discussed in this paper is particle swarm optimization.

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