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Implementation of volt/var control strategy for distribution systems

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The volt/var control strategy is one of the important functions of distribution automation. Voltage profile improvement is seen as an integral part of the power quality concept.

Various methods for volt/var control are studied for the purpose. The modern methods use lower power Power Electronics-based devices for improving the voltage whereas traditional methods employ capacitors and voltage regulators. There are many methods available in literature for solving the general capacitor problem. Genetic Algorithm, Tabu Search and Simulated Annealing are some of these optimisation techniques.

A robust power flow method is a prerequisite for these methods. A power flow method has two parts. Firstly we have to model the different system components. Then a suitable numerical method is used to obtain the solution.

Three-phase distribution load flow is much different from the transmission load flow. In distribution load flow, we have to take into account the unbalanced loads, untransposed lines and other peculiar features of the distribution system into account. As part of this work, various methods of distribution load flow are studied. Presently an algorithm is being built to obtain the Load Flow solution. It is a network topology based load flow, especially used for the radial distribution system. Also various system components like lines and transformers will be modelled. These models can be used in the numerical method for getting the converged values of voltages and angles.

Actual data from the site will be collected. By using those values, load flow solution will be obtained. The results of load flow will be utilised to study and analyse the voltage profile for improvement. General capacitor problem will be solved. Finally a cost-effective solution will be proposed. The remedy for possible practical problems will be suggested.

The implementation of strategy is expected to reduce the peak demand, the energy loss along with the improvement of voltage profile. As a result, it will prove to be justifiable on economic basis also.

The project is relevant to Indian utilities like MSEB in the changed scenario, where reliable and quality power has to be supplied to consumers at optimum cost. Thus it is beneficial to the consumer, the utility and society as a whole.

Simulation of Turbine Load Governing System for Dahanu Thermal Power Station

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The turbine governing system is vital for the safety and availability of the plant. The objective of the project is to stimulate the turbine load management system for Dahanu Thermal Power Plant, BSES. It consists of hydraulic and electro-hydraulic governing in which there are servo-valve components. The dynamic characteristics of these systems are non-linear and difficult to control. Modelling for all components of governing components is required to be done and then validation of the system will be carried out.

In order to maintain the synchronous speed under changing load/grid or steam conditions, the turbine is equipped with electro-hydraulic governors fully backed up by a hydraulic governor.

(1) To trip the turbine whenever turbine protections operate, to test the turbine protections with the help of automatic turbine testing;
(2) to control speed, load or pressure by regulating steam flow into turbine;
(3) to avoid turbine overspeed either during rolling or during loads throw-off.

Load management of turbines is achieved by interaction of the control valve operated by either electro-hydraulic or hydraulic governing. By co-ordination of stop and control valves steam is admitted either in nozzle control or in throttle control mode into the turbine and machine load/speed can be controlled. For controlling valves, hydraulic oil is used along with mechanical linkages, servomotors. These fluid signals are again generated through various controllers where electronic signals are converted to hydraulic signals. The machine can be run on various modes as pressure control, speed control and load control. Each one of them will have different characteristics. The turbine protection system also uses electronic and hydraulic signals.

The objective of this project is:

(1) modelling and simulation of various components of the governing system
(2) simulation of system under varying operating load conditions
(3) checking characteristics and settings of various components and modification according to need
(4) fault location using this simulated system
(5) to use the simulator for training.