OPTIMAL POWER FLOW FOR VOLTAGE STABILITY IMPROVEMENT BY USING EVOLUTIONARY PROGRAMMING OPTIMIZATION TECHNIQUE

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ABSTRACT

This project presents a methodology for solving Optimal Power Flow (OPF) problem by using Evolutionary Programming (EP) Optimization technique in order to improve the voltage stability, minimize the cost of generation and minimize the losses in the power system. This study has developed the Evolutionary Programming (EP) optimization technique using MATLAB software. The study tested three fitness functions namely total cost minimization, total loss minimization and the voltage stability improvement in power system. Comparison in the results obtained was made in order to determine the best fitness function to be used for solving OPF and hence the voltage stability is improved. The proposed technique was tested on the IEEE 26-bus reliability test system.

Keywords:
Optimal power flow (OPF), voltage stability improvement, evolutionary Programming (EP).

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The increasing dependency on the use of electricity has compelled utility suppliers to maintain a high standard of system reliability. This has increased the importance of analyzing and preventing voltage collapse that is likely to take place in heavily loaded systems. Excessive reactive power absorption by the load and system itself is identified as primary causes of voltage collapse. It is now an established fact that voltage collapse is a slow dynamic phenomenon, typically identified as a lowering of voltage level and followed by a sudden voltage decay leading to collapse.

Optimal Power Flows are a relatively new tool available to utility planners. Ordinary power flows calculate system parameters such as voltages at load buses corresponding to a specified setting of variables such as generator power output. Optimal Power Flows attempt to find the best possible setting for a list of control variables such that a desired objective is met. Typical objectives are minimization of losses, minimization of fuel costs and minimization of added VArs. Sometimes a weighted composite objective function may be formed (e.g., minimize losses and at the same time minimize VAr additions). The control variables include generator bus voltage, transformer and phase shifter settings, real power at generator buses, addition of VArs and shedding load. In addition Optimal Power Flows obey specified constraints such as maintaining bus voltages, line flows, interface flows, transformer and phase angle regulator settings as well as real and reactive power limits [1].

Some Optimal Power Flows also model system security constraints which set the optimal control settings such that the system can "survive" a specified list of contingencies. A contingency is defined as a set of system component outages (e.g., line, bus or generator outage combinations). "Survival" means that emergency limits (e.g. voltage and line flow limits) are not exceeded in any of the contingency cases. It also refers to maintaining steady-state stability which is implied by a solved ac load flow [1].