VOLTAGE AND REACTIVE POWER CONTROL FOR POWER LOSS MINIMIZATION USING APPROXIMATE STOCHASTIC ANNEALING

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Efficient management of voltage profiles and reactive power in power distribution systems plays an important role towards this goal. In this paper, we propose to use an approximate stochastic annealing (ASA) algorithm for solving the voltage and reactive power control (VVC) problem. The objective is to determine the proper settings of capacitor banks and transformer taps in a power distribution system to minimize daily energy losses. Several types of constraints, such as voltage constraints and operation limits constraints on transformer load tap changers (LTCs) and shunt capacitors (SCs), are considered in our model. In this work, the original ASA algorithm is adapted for solving the VVC problem by sampling from a sequence of probability distributions over the space of all possible configurations of LTCs and SCs. A Lagrangian Relaxation-Dynamic Programming (LR-DP) algorithm is also proposed to obtain upper and lower bounds on the performance of the optimal solution. The performance of the ASA algorithm is illustrated on a well-known PG&E 69-bus distribution network. Our testing results indicate that the ASA algorithm may yield solutions very close to optimum within a modest amount of computational time.