A Convex OPF Approximation for DC Networks Considering Voltage-Dependent Load Models

Abstract

This paper addresses the problems of power flow and optimal power flow analysis considering voltage-dependent load models from the convex point of view. First, Taylor series expansion method is employed for linearizing the power flow equations generating a set of affine h yperplanes. S econd, the sequential quadratic programming (SQP) approach is employed for adjusting the linearization point to eliminate the voltage estimation error between the exact and proposed convex models recursively. Two voltage-dependent load models are considered in our power flow a nd o ptimal p ower fl ow pr oposals wh ich based on the exponential and polynomial models. General algebraic modeling system (GAMS) and its nonlinear optimization packages are employed for comparison purposes. Two DC-test systems with 6 and 21 nodes are used to validate the performance of the SQP proposed. The proposed SQP approach is implemented in MATLAB software with quadprog toolbox.