

2011 2nd International Conference on Advances in Energy Engineering (ICAEE 2011)

Power System Voltage and Reactive Power Control by means of Multi-agent Approach

Masato Ishida^a, Takeshi Nagata^a*^a

^a*Hiroshima Institute of Technology, 2-1-1, Miyake, Saeki-ku, Hiroshima, 731-5139, Japan*

Abstract

In order to maintain system voltage within the optimal range and prevent voltage instability phenomena before they occur, a variety of phase modifying equipments are installed in optimal locations throughout the power system network and a variety of methods of voltage and reactive control are employed. The proposed system divided the traditional method to control voltage and reactive power into two sub problems: "voltage control" to adjust the secondary bus voltage of substations, and "reactive power control" to adjust the primary bus voltage. In this system, two types of agents are installed in substations in order to cooperate "voltage control" and "reactive power control".

In order to verify the performance of the proposed method, it has been applied to the model network system. The results confirm that our proposed method is able to control violent fluctuations in load.

© 2011 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of the organizing committee of 2nd International Conference on Advances in Energy Engineering (ICAEE). Open access under [CC BY-NC-ND license](#).

Keywords: Multi-agent system; distributed system; voltage control; reactive power control; power system;

1. Introduction

Numerous studies have been conducted the control of voltage and reactive power. From the viewpoint of system structures, this research can be divided into two categories: one covering centralized systems and the other decentralized. A centralized system [1]-[4] collects all data on the power system at a single point and solves problems of phase modifiers and tap operations of load tap-changing transformers as

* Corresponding author. Tel.: +81-82-921-3121; fax: +81-82-921-8934.

E-mail address: m161001@cc.it-hiroshima.ac.jp.

problems of optimization. For problem solving with these kinds of systems, some methods have been proposed that utilize mathematical programming and/or soft computing. Meanwhile, a decentralized system [5]-[8] locally exchanges information among neighboring substations for autonomous control. For this category, some methods have been put forward to harmonize tapping and phase modification of transformers.

The proposed system divides the traditional methods to control voltage and reactive power into two sub problems: "voltage control" to adjust the secondary bus voltage of substations, and "reactive power control" to adjust the primary bus voltage. We propose a decentralized system featuring agents and a method that divides all control voltage and reactive power into these two sub problems. In doing so, we intend to clarify what needs to be controlled to obtain more flexible control. Reference [7] describes the results of our previous research focused on the sub problem of "voltage control." In the proposed control method, agents of upper-layer substations change the dead bands of VQC adaptively (i.e., they control the target voltage), based on information collected from agents of lower-layer substations, to enable more flexible control. Reference [8] describes the results of our previous research focused on the method on the sub problem of "reactive power control." In the proposed control method, agents of each substation adjusts the reactive power among the same voltage class, thus keeping the primary voltage within the upper and lower limits and equalizing the voltage distribution, to enable more flexible control.

This paper, therefore, focuses a method that adding the reactive power control to the voltage control, and proposes a method that adjusts the primary bus voltage and the secondary bus voltage of substations interconnected in the same voltage class.

Listed below are the features of the proposed method:

- (1) The proposed system divides the traditional methods to control voltage and reactive power into two sub problems: "voltage control" to adjust the secondary bus voltage of substations, and "reactive power control" to adjust the primary bus voltage.
- (2) The proposed system consists of two kinds of agents: substation agent (SSAgent) and transmission line agent (LineAgent).
- (3) Each SSAgent corresponds to a substation and is implemented by the computer in each substation, while each LineAgent corresponds to transmission lines which connect to the equi-potential substations and can be implemented by any computer in any substation.
- (4) In the proposed system, LineAgent cooperates with SSAgent toward a resolution of the voltage control issues. In this paper, we propose a new index, "integrated target voltage range (ITVR)", which coordinates with two sub-problems (voltage control and reactive power control).

We conducted a computer simulation by developing the proposed system with Java and applying it to a model power system based on an actual system. From results, we confirmed that the proposed method achieves better performance than the conventional VQC.

2. The Proposed method

The method we propose in this paper is intended for the radial system with the branches and the multiple power lines.

2.1. Overview

We illustrate basic idea of the proposed method as shown in Fig.1. In the proposed method, the model network is divided into sub-networks (H1) and (H2), which are controlled by the shunt capacitor/shunt reactor (SC/ShR), and sub-networks (V1) through (V4), which are controlled by the under-load tap

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات