ترجمه بازار

مرکز خدمات ترجمه تخصصی ترجمه بازار

نام مشتری

نمونه ترجمه مقاله رشته ---

شماره پروژه ترجمه

نمونه ترجمه

ترجمه مقاله ☒

ترجمه کتاب ☐

کنترل ولتاژ و توان راکتیو برای به حداکثر رساندن صرفه جویی در انرژی در سیستم توزیع نیرو با انرژی بادی

پیچیده

معمولاً از تنظیم کننده‌های ولتاژ و بانک‌های خازنی به عنوان دستگاه کنترل ولتاژ و توان راکتیو (ولت / ولتاژ) در سیستم توزیع، استفاده می‌شود. می‌توان با استفاده از کنترل ولت / VAr برای صرفه جویی در انرژی، مکانیزم خاصی ایجاد کرد که به عنوان کاهش ولتاژ (CVR) شناخته می‌شود. سیستم توزیع فعال با نفوذ زیاد نسل‌های توزیع (DG) مکانیزم اضافی را برای کنترل ولتاژ / ولتاژ ارائه می‌دهد. سهم منحصر به فرد این مقاله توسعه یک الگوریتم محاسباتی برای بهینه سازی ولت / ولتاژ هوشمند و کنترل شبکه‌های توزیع پیچیده با مشارکت فعال از DG است، تا حداکثر صرفه جویی در مصرف انرژی در شبکه از طریق CVR انجام شود. برای به دست آوردن تنظیمات بهینه تنظیم کننده ولتاژ، وضعیت خازن سوئیچ شده و اندازه ولتاژ باس کنترل شده DG، مشکل بهینه سازی ولت / VAr حل شده است. این روش یک معماری ولت / VAr هماهنگ و منحصر به فردی را ارائه می‌دهد که می‌تواند در سیستم مدیریت توزیع (DMS) کاربرد پیدا کند. با توجه به سازگاری با متغیرهای ترکیبی، استحکام در حل مشکلات بهینه‌سازی غیرخطی و سهولت اجرا، از روش بهینه‌سازی ازدحام ذرات استفاده شده است. نتایج در برابر یک استراتژی جستجوی جامع برای سیستم توزیع گذرگاه IEEE 13 و IEEE 37 و همچنین با استفاده از نرم افزار توزیع تجاری SynerGEE تأیید شده است. همچنین نتایج برای یک فیدر سودمند همراه با تجزیه و تحلیل دقیق ارائه شده است.

متن اصلی (انگلیسی) در صفحه بعدی آمده است ...

Voltage and Reactive Power Control to Maximize the Energy Savings in Power Distribution System with Wind Energy

Rahul Anilkumar
Member, IEEE
Quanta Technology
428 13th Street
San Francisco, CA 94612, USA
kumar.rahulanil@gmail.com

Griet Devriese
Member, IEEE
Power Engineers
Clarkston, WA, USA
odditygriet@gmail.com

Anurag K Srivastava
Senior Member, IEEE
Washington State University
355 Spokane St.
Pullman, WA 99163, USA
asrivast@eecs.wsu.edu

***Abstract* – Commonly, voltage regulators and capacitor banks are used as control devices for voltage and reactive power (volt/VAr) control in distribution system. A specific mechanism can be developed using volt/VAr control for energy savings known as Conservation Voltage reduction (CVR). Active distribution system with high penetration of distribution generations (DG's) offers additional mechanism for volt/VAr control. The unique contribution of this paper is development of a computational algorithm for intelligent volt/VAr optimization and control of complex distribution networks with active participation from DG's, to maximize overall network energy savings through CVR. Proposed volt/ VAr optimization problem is solved to find the optimal voltage regulator settings, switched capacitor states and voltage magnitude of DG controlled bus. This work presents a unique coordinated volt/VAr architecture that can find application in Distribution Management System (DMS). Particle Swarm Optimization has been used, given compatibility with combinatorial variables, robustness in solving nonlinear optimization problems and ease of implementation. The results have been validated against an exhaustive search strategy for the IEEE 13 bus and IEEE 37 bus distribution system and also using commercial distribution software SynerGEE. Results are also presented for a utility feeder with detailed analysis.**

support the grid with additional reactive power at the point of common coupling. The IEEE 1547 standards form the basis for DG interconnection into the distribution network. In accordance with these standards, DGs should maintain a constant power factor close to unity at PCC. Additional switched capacitor bank support is allowed in order to meet this requirement [11]. Although these standards prohibit active voltage regulation, it is permissible to perform voltage regulation if a mutual agreement between the utility and DG owner exists [6]. Depending on the size of the DG, they can be operated either in power factor control mode, voltage control mode or voltage regulation mode [6]. Currently, the smaller DG units are controlled in power factor control mode, while the larger units generally operate with voltage control [1]. In the power factor control mode, the power factor is maintained unity at Point of Common Coupling (PCC), by modeling as a PQ bus with negative current injections.

Voltage control mode maintains voltage of PCC bus at a constant value, generally 1 p.u, whereas voltage regulating mode allows for active voltage regulation at the PCC bus, thereby accommodating additional VAr support in the multi-objective scenario based volt/VAr control algorithm is proposed in [16] which account for the stochastic behavior of renewable technologies while optimizing the network with capacitor banks and load tap changing transformers solved using the modified teaching learning algorithm. Synchronous distributed generation is considered in a coordinated control strategy with capacitor states and load tap changers to minimize network losses in [17]. The authors in [18] discuss new opportunities in DMS applications of volt/VAr control and feeder reconfiguration. The work in [19] proposes an algorithm to alleviate voltage control problem when installing distributed generation. The work in [20] proposes an optimized distributed control approach based on sensitivity analysis and on decentralized active/reactive power regulation which tries to minimize network losses and reactive power exchanged between the DG and distribution network. The authors of [21] modeled the volt/VAr problem in a stochastic framework by proposing a method to regulate the voltage profile of the operation planning the distribution network.

While developing a volt/VAr control scheme for an active distribution system, the operating characteristics of DG units and the complex behavior of different DG control modes should be taken into account to better understand their impact on the network state variables. Further there is a need to coordinate and control all VAr sources by accounting for the impact of DG parameters as a control variable in the problem formulation, while identifying the optimal operating states of the other control devices which include the switched capacitor states and voltage regulator settings [22, 23]. Most of the existing works focus on power factor control mode of operation, while optimizing the distribution network.

Original contributions of this paper are development of an intelligent computational algorithm for coordinated volt/VAr control considering the impact of different control modes of DG operation, while maximizing the energy savings of an active distribution system. Energy saving is achieved by lowering the voltage along the feeder with flatter voltage profile but keeping the voltage within allowable limits. Load consumption by voltage dependent load reduces by lowering the voltage and this mechanism is known as conservation voltage reduction (CVR). The problem has been solved for capacitor placement for any given feeder, and the operational stage by coordinated voltage control for maximum energy savings. Note that, this paper is focused on technical aspects and economic aspects have not been considered. During the capacitor placement stage, capacitor locations are determined using traditional loss sensitivity analysis. During operational

the voltage regulation mode, the voltage of the generator bus at PCC is added as a control variable into the optimization problem. Hence, in addition to switched capacitor states and VR settings, the optimum DG operating voltage is determined that maximizes the network energy savings.

The developed optimization algorithm has been tested on the IEEE 13 bus and IEEE 37 bus distribution test feeders. Cases have been simulated, with DG integration into the network, while identifying potential energy saving benefits of each DG mode of operation. The obtained results with and without DG are then validated using a commercial distribution planning tool, SynerGEE [24].

II. Problem Formulation

In this work, the overall energy savings of the active distribution system are maximized while determining the optimal operating states of different control devices. Energy savings can be realized in the form of kW energy savings, or kVA energy savings. The objective function is defined as follows:

$$Maximize\ ES = 100\%.\frac{P_{system_{base\ case}} - P_{system_i}}{P_{system_{base\ case}}} \quad (1)$$

Where ES denotes the energy savings, $P_{system_{base\ case}}$ represents the kW results obtained after solving the base case power flow without volt/VAr control, and P_{system_i} denotes the kW power flow results obtained for each 'i[th]' possible operation with volt/ VAr control.

The objective is subject to the following inequality constraints

$$V_i^{min} \le V_i \le V_i^{max} \quad (2)$$

$$V_j^{min} \le V_j \le V_j^{max} \quad (3)$$

$$Q_j^{min} \le Q_j \le Q_j^{max} \quad (4)$$

$$0.95\ lagging \le PF_i \quad (5)$$

$$0.98\ leading \le PF_i \quad (6)$$

Where

V_i = Bus voltage for i^{th} load bus.
V_j = Bus voltage for j^{th} DG bus.
Q_j = Reactive power for j^{th} DG bus.
PF_i= Power factor for i^{th} load bus.
P_i^{calc} = Calculated real power for i^{th} load bus, "s" phase
S_i^s= Apparent power for i^{th} load bus, "s" phase

$$PF = {(P_i^{calc})^s}/{S_i^s} \quad (7)$$

The equality constraints are the power flow equations.