Noiseless Consensus based Economic Dispatch Algorithm in conjunction with STATCOM Controller for Reactive Power Compensation in Islanded Microgrids to enhance Voltage and Power Stability

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***Abstract*—Economic Dispatch aims to minimize the total cost of operation/generation of microgrids while meeting all the defined constraints. Since microgrids consist of distributed generators, it is imperative for these generators to communicate seamlessly with each other without any losses and to ensure secure operation of the microgrid. With the use of distributed generators, noise is inherent in the system. This paper focuses on including noises as a constraint in an islanded microgrid to find a better economic dispatch solution. It also introduces a STATCOM controller for reactive power management. The controller will help provide stability to the microgrid's voltage, output power and phase angle. This will enhance the microgrid's performance and make it a more resilient system.**

***Keywords*—Microgrids, consensus based algorithm, economic dispatch, distributed generators, STATCOM controller, phase angle.**

I. Introduction

In this paper, microgrid in islanded mode is under analysis. Most cases consider only active power stability during analysis. However, it is necessary to include reactive power in the analysis to provide an overall stability to the system. Reactive power irregularities are an important factor to be considered. [1]-[4] have used different methods to solve economic dispatch problem. [5]-[8] study consensus based algorithm. Demand side management has been introduced and studied in [9]-[15]. Effects of noise has been considered in [16]-[19]. Distributed approach i.e. central controller is not used in [20]-[25] to solve the economic dispatch problem. FACTS devices have been predominantly used to provide compensation for voltage and phase angle instability [26]. This instability in the system could be due to load fluctuations or inherent noise in the system. STATCOMs are one of the commonly used devices for this purpose amongst many others. This paper uses STATCOM based controller to provide voltage and phase angle stability to the islanded microgrid during different noise conditions in a short span of time. STATCOM uses voltage source converter to provide shunt compensation in the microgrid system [27]. Another advantage is that it provides less damping, low harmonics, better response and improved voltage profile in the system [28].

This paper is divided into the following sections: Section II introduces the STATCOM controller. Section III and IV defines the microgrid system and economic dispatch problem respectively. Section V discusses the distributed noise-resilient economic dispatch approach [19]. Section VI includes results and discussion and Section VII provides conclusions.

II. STATCOM Controller Model

STATCOM is also known as static synchronous compensator/condenser. It is a device famously used for voltage regulation. It is a part of FACTS (flexible alternating current transmission system) family used to increase power transfer capability and improved controllability of the transmission system. It does so by supplying reactive power to the microgrid. A PI (proportional integral) controller is used in conjunction with the STATCOM. PI controller helps reduce voltage flicker in the system [29].

Although static var compensation can also be used for voltage stability, STATCOM has better characteristics because it exhibits constant current characteristic during voltage lower than its predefined low limit. STATCOM's are expensive than static var compensation but have low harmonics and faster response. Fig. 1 provides the model of STATCOM with PI controller. α is the angle of output voltage.

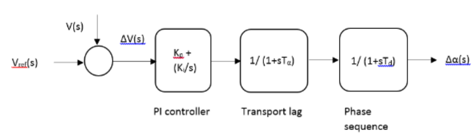

Fig. 1 Transfer function model of STATCOM with PI controller [30]

III. Microgrid Structure

The microgrid under analysis for this paper consists of 3 generator units. It is in islanded mode and has a solar/Photovoltaic (PV) generator, wind (doubly fed induction generator-DFIG) generator and a steam turbine unit as shown in

Fig. 2. Consumer load is assumed as a delta-connected load. STATCOM provides reactive power required to maintain balance in the microgrid. This balance is required due to change in PV generation, change in wind generator output (due to change in wind speed), reactive power load and inherent noise in the microgrid's components. A balance equation for reactive power of the figure below is formulated. The reactive power balance equation is formulated using the following assumption: Reactive power is fed by the STATCOM, PV system and steam turbine unit into the bus and reactive power is sent to the Consumer load and Wind system from the bus.

Table I provides the parameter's values for various generators used in this paper's analysis. Cost-coefficients, minimum and maximum power generation limits of the units are provided below.

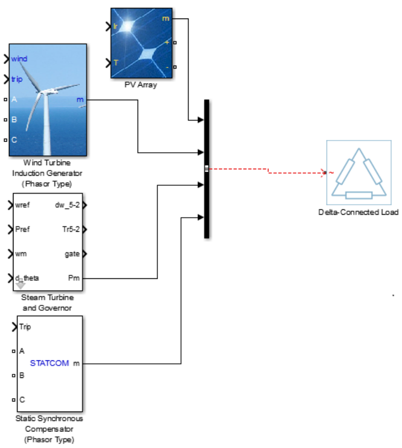

Fig. 2 Microgrid structure including PV, Wind Generator, Steam Turbine and STATCOM Controller as bus inputs and Delta connected load as output from the bus

TABLE I. List of parameters for generators

Unit	P_{min}(kW)	P_{max}(kW)	a	b	c
1 (PV)	4	18	0.070	2.15	56
2 (Wind)	8	40	0.080	1.15	50
3 (Steam)	5	25	0.070	3.3	41

The reactive power balance equation based on Fig. 1 is written as follows:

$$\Delta Q_{PV} + \Delta Q_{ST} + \Delta Q_{STATCOM} = \Delta Q_L + \Delta Q_{IG} \qquad (1a)$$

Change in load or noise level, changes the terminal voltage which in turn changes the reactive power output of the different microgrid components. This changes the output voltage of microgrid [30]:

$$\Delta V(s) = \frac{K_v}{1+sT_v}[\Delta Q_{PV}(s) + \Delta Q_{ST}(s) + \Delta Q_{STATCOM}(s) - \Delta Q_L(s) - \Delta Q_{IG}(s)] \qquad (1b)$$

Where, ΔQ_{PV} is reactive power output of PV

ΔQ_{ST} is reactive power output of steam turbine

$\Delta Q_{STATCOM}$ is reactive power output of STATCOM controller

ΔQ_L is reactive power output of consumer load

ΔQ_{IG} is reactive power output of wind generator

$\frac{K_v}{1+sT_v}$ is the derivative of different components' reactive output power with respect to time and voltage

The primary objective of this analysis is to make the system more stable under noise conditions and reduce damping in the microgrid system. Voltage stability margin is achieved by minimum increment in terminal voltage of the system and less damping in the system. Integral absolute error (IAE), Integral square error (ISE), Integral square time error (ISTE) are some performance indexes used to reduce overshoot, settling time, rise time, steady-state error of the terminal voltage. Table II provides values of these parameters for PI controller used with the STATCOM.

TABLE II. Parameter values

System parameter	PI Controller
K_p	61
K_i	13000
IAE	960
ITSE	23
ITAE	16
Rise time	0.09
Overshoot	0.02

IV. Economic Dispatch Formulaton

The Langrangian method is used to define the economic dispatch problem for grid-connected microgrid. First, the objective function of the microgrid is defined. This function is most commonly used in solving economic dispatch problems. Considering i (1, 2, 3,…, n) units of generation in a microgrid system, the cost of a generator can be defined in terms of a quadratic equation. The units' cost function is described in the quadratic equation (2a). P_{loss} has been assumed as 7% of the total load.

$$\sum_{i=1}^{n} C_i P_i = \sum_{i=1}^{n} a_i P_i^2 + b_i P_i + c_i \qquad (2a)$$

Where, $C_i P_i$ is the cost of generator i

a_i, b_i, c_i are the cost co-efficient

P_i is the total power output of the generator

For economic dispatch problem, we want to minimize the generation cost of the microgrid. Equation (2a) becomes:

$$\min \sum_{i=1}^{n} C_i P_i = \min \sum_{i=1}^{n} a_i P_i^2 + b_i P_i + c_i \qquad (2b)$$

Also, total power output of generator can be defined as:

$$\sum_{i=1}^{n} P_i = P_D + P_{loss} \text{ , for } P_i^{min} < P_i < P_i^{max} \qquad (2c)$$

Where, P_D is the total load and P_{loss} are the losses incurred during transmission of power from generation units to the loads. P_i^{min} is the minimum generation limit of generator i and P_i^{max} is the maximum generation limit of generator i.

To formulate the Lagrangian function, equation (2a), (2b) and (2c) becomes:

$$L(P_1, P_2, \ldots P_n) = \sum_{i=1}^{n} C_i P_i + \lambda(P_D + P_{loss} - \sum_{i=1}^{n} P_i) + \sum_{i=1}^{n} u_x(P_i - P_i^{max}) + \sum_{i=1}^{n} u_y(P_i^{min} - P_i) \quad (3)$$

Where, λ, u_x, u_y are Lagrange multipliers.

To find a solution of the above economic dispatch problem, incremental cost ($IC_1, IC_2, \ldots, IC_n$) for each generator should be calculated. To find the minimized cost of the microgrid, these incremental cost for different generators should be equal to each other, i.e.,

$IC_1 = IC_2 = \ldots = IC_n$
where, n = number of generation units

Solution to this problem, is most commonly used solution:

$$\lambda_i = \frac{\partial C_i P_i}{\partial P_i} = 2a_i P_i + b_i = \lambda^* \qquad P_i^{min} < P_i < P_i^{max}$$

$$\lambda_i = \frac{\partial C_i P_i}{\partial P_i} = 2a_i P_i + b_i < \lambda^* \qquad P_i = P_i^{max}$$

$$\lambda_i = \frac{\partial C_i P_i}{\partial P_i} = 2a_i P_i + b_i > \lambda^* \qquad P_i = P_i^{min} \quad (4)$$

Where, λ_i and λ^* are incremental cost and optimal incremental cost respectively. So, the economic dispatch problem has to take into account generation limits for each generator to find an economic dispatch schedule for the microgrid. If there are no equality or inequality constraints to be considered for the generators, then it is fairly easy to solve economic dispatch problem. However, most of the problems have some constraints that need to be considered while solving economic dispatch problem for microgrids. The above equations provided are the basic problem formulation for any economic dispatch related problems.

V. CONSENSUS-BASED ECONOMIC DISPATCH APPROACH FOR NOISELESS COMMUNICATION [19]

In this section, the approach introduced in [19] is explained. The communication link for the microgrid is defined. There is an agent corresponding to each generator unit, which collects information from their respective units. This information is processed by a specific agent. All the agents in the communication system are also connected to each other. Since, our islanded mode microgrid has 3 generation units, we have 3 agents in total, and each connected to their specified unit. The information collected and processed by the agents is exchanged between each other. This exchange helps provide information regarding the present status of each unit. This information is used to change the output power from each unit (while keeping their constraints in check), to minimize the total cost of the microgrid system. Noise from the components, surroundings, electric/magnetic interference are some of the reasons assumed in this analysis. Noise accumulated due to communication between units as well as between units and agents have been included in this approach. They have been modeled as Gaussian noise [16]. Communication links can be selected as c_{12}, c_{21}, c_{23}, c_{32}. Corresponding incremental cost of each unit is calculated by their respective agent and then exchanged with each other. Set point of output power is calculated based on the information and is sent to their respective generation units. Accordingly, the units change their power generation to have equal incremental cost to solve the economic dispatch problem. This leads to the overall minimization of microgrid cost.

[19] has formulated this approach as follows:

$$X[k+1] = X[k] + \mu[k][M\,x[k] + WD[k]]$$

$$M = -H'GH,\ W = H'G,\ H = H_2 - H_1 \quad (5)$$

Where, X[k] is the incremental cost of units at kth iteration

X[k+1] is the incremental cost of units at (k+1)th iteration

μ[k] is recursive step size

G is r×r diagonal matrix with link control gain as its diagonal elements

H_1 and H_2 are r×n matrix in which rows are elementary vectors.

D[k] is the noise in the communication link

$$H_1 = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}, H_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}; H = \begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & -1 \\ 0 & -1 & 1 \end{bmatrix} =$$

$H_2 - H_1$ and G (small noise) = diag [0.2 0.2 0.2]

Similarly, M and W can be calculated using the formula in (5). Next step is to average the incremental costs of all the units in order to reduce the effects of noise. This will result in a more resilient and stable microgrid devoid of any (lesser) communication noise.

$$\begin{aligned} X_{avg}[k+1] &= \frac{1}{k+1} \sum_{j=1}^{k+1} X[j] \\ &= \frac{1}{k+1} \sum_{j=1}^{k} x[j] + X[k+1] \\ &= X_{avg}[k] - \frac{1}{k+1} X_{avg}[k] + \frac{1}{k+1} X[k+1] \end{aligned} \quad (6)$$

From (5) and (6), the noiseless economic dispatch approach is concluded as [19]:

$$X[k+1] = X[k] + \mu[k][M\,x[k] + WD[k]]$$

$$X_{avg}[k+1] = X_{avg}[k] + \frac{1}{k+1}[X[k+1] - X_{avg}[k]] \quad (7)$$

Where, $X_{avg}[k+1]$ are set points for incremental costs of units. This method is iterative in nature and an estimate is made using the step size, which is then averaged in later stages to reduce the effect of noise.

VI. Results and Discussions

Initially the microgrid is studied when there is no noise in the system. The economic dispatch algorithm provided in the previous section along with reactive power compensation is tested to see the performance of the system in absence of noise. In the second condition, noise of variance 0.2 is introduced in the system, and the performance is observed. During the third condition, noise variance is increased to 0.5 and for the final condition, the noise variance is set to 0.8. The performance of the microgrid under different noise conditions has been analyzed using MATLAB. In all the cases, power output of the 3 generator units tries to maintain its optimal dispatch schedule with the introduction of different noise levels. In Fig. 11, a comparison has been made to show how the terminal voltage stabilizes under various noise conditions. Fig. 3 shows varying terminal voltage of the system under 60 sec period. This case is simulated under noise free conditions. It takes less than 10 sec for the system to reach a constant output terminal voltage when reactive power compensation is provided in the system. Fig. 4, Fig. 5 and Fig. 6 shows terminal voltage during some noise variance. In this study, we have considered small (variance of 0.2), medium (variance of 0.5) and large (variance of 0.8) noise levels to simulate the system and observe its behavioral pattern for the chosen consensus-based algorithm. From Fig. 3-Fig. 6, the system has been compared in presence and absence of reactive power compensation. From all the assumed noise conditions, it can be seen that there are less oscillations in the system with presence of the STATCOM controller. Hence, it can be concluded that microgrid becomes more stable and efficient with addition of reactive power compensation in economic dispatch problem.

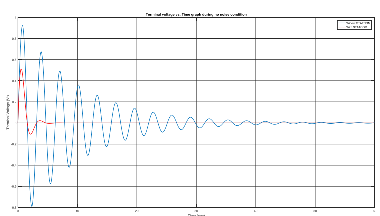

Fig. 3 Terminal voltage characteristic without noise

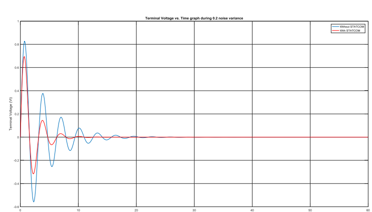

Fig. 4 Terminal voltage characteristic with 0.2 noise variance

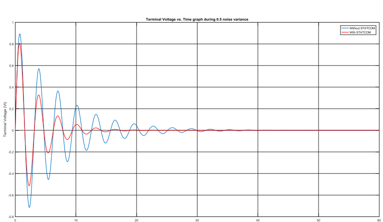

Fig. 5 Terminal voltage characteristic with 0.5 noise variance

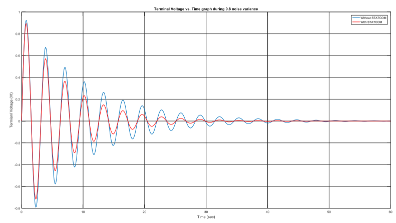

Fig. 6 Terminal voltage characteristic with 0.8 noise variance

In all the above figures, it is visible that the system takes a couple of seconds to reach a constant value. The higher the noise, the more time it is taken by the system to reach to the desired value. However, it can be seen that for the same economic dispatch algorithm, the microgrid is more stable and efficient when reactive power compensation is also included. It accounts for fewer oscillations and harmonics. Fig. 7-Fig. 10 shows phase angle behavior with respect to time for different noise conditions. Again, it can be seen that when reactive power is compensated in the system, its phase angle is more stable and reaches constant value in less time.

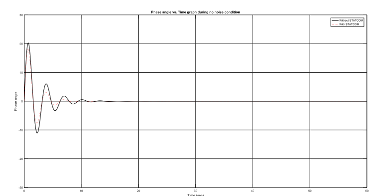

Fig. 7 Phase angle characteristic without noise

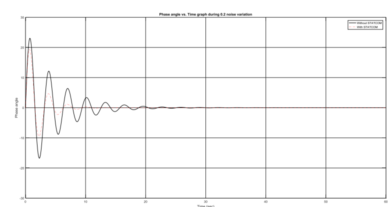

Fig. 8 Phase angle characteristic with 0.2 noise variance

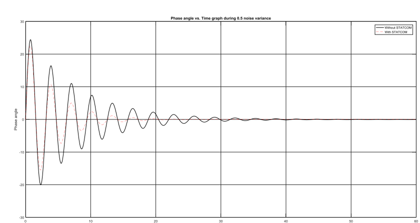

Fig. 9 Phase angle characteristic with 0.5 noise variance

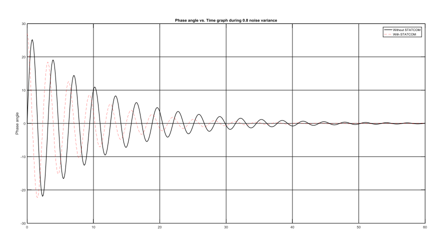

Fig. 10 Phase angle characteristic with 0.8 noise variance

Fig. 11 shows comparisons between terminal voltage of the microgrid system with respect to time under different noise conditions. As seen from the graph, higher noise variance (purple legend) is not easy to stabilize the microgrid during islanded mode, and takes time to stabilize itself. Reactive power compensation helps stabilize the system very fast for low to medium level noise. This can be also be concluded from the graph by looking at the red, black, and pink legends with correspond to no noise, low and medium noise variance respectively. For phase angle stability, it is observed that with only use of economic dispatch algorithm for optimal schedule, the system takes longer to stabilize itself. This leads to a less stable, low efficient and slow response microgrid system. With addition of reactive power compensation, the system gives faster response and is more stable. In power systems, it is important for a system to be resilient and have faster response because load keeps changing most of the time and is hardly ever constant. Hence, it is important for a system to be ready to take up these challenges and be more resilient. This consensus based economic dispatch algorithm in conjunction with STATCOM based reactive power compensation provides the necessary stability and resiliency.

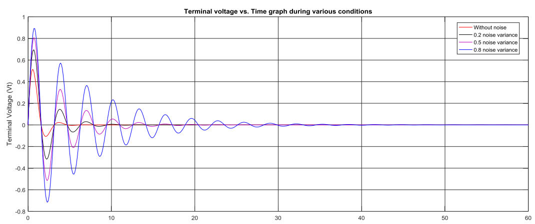

Fig. 11 Comparison of terminal voltage for all noise conditions

Fig. 12 showcases power output of the generator units for no noise condition with reactive power compensation.

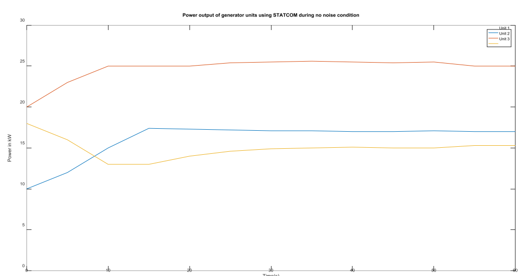

Fig. 12 Power output of generator units without noise

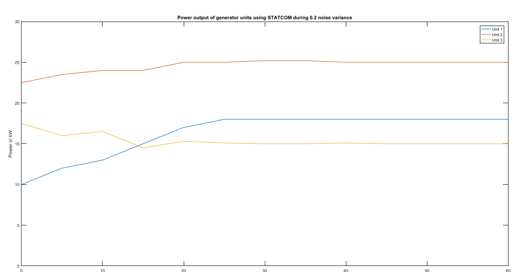

Fig. 13 Power output of generator units with 0.2 noise variance

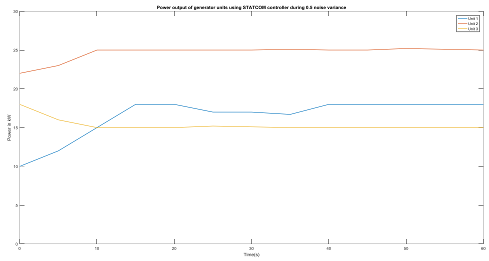

Fig. 14 Power output of generator units with 0.5 noise variance

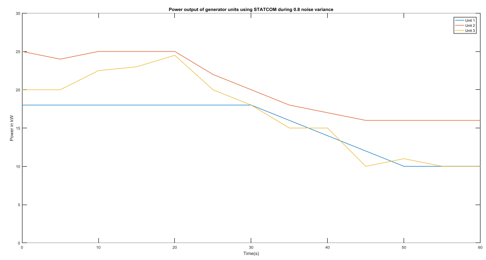

Fig. 15 Power output of generator units with 0.8 noise variance

Fig. 13-Fig. 15 showcases power output of the generator units during different noise conditions with reactive power compensation. It can be concluded from Fig. 15 that there is a shift in economic dispatch solution due to large variance in noise. During no noise condition, the system takes less than 20 sec to reach constant power output. The system takes 25 sec for 0.2 noise variance, around 40 sec for 0.5 noise variance and 50 sec for 0.8 noise variance to reach constant power output.

VII. Conclusions

The proposed consensus based algorithm for economic dispatch works well for islanded microgrids [19]. In this paper, this proposed algorithm was used to analyze the behavior of microgrid during islanded mode in conjunction with STATCOM based reactive power compensation. The microgrid shows good response for different noise levels when reactive power is compensated in the system. It brings the system close to constant output power in less time. However, it was observed that it took longer for the system to reach its desired stability without any reactive power compensation. The system had more harmonics and oscillations for a longer time and hence can be said that it took longer to achieve stability. It can be concluded from this study, that this consensus based economic dispatch algorithm with reactive power compensation is very good for islanded microgrids during small, medium, and large variance noises. It provides stability, efficiency, and resiliency to the system in a short span of time based on the case study.

Acknowledgment

The noiseless consensus based algorithm for economic dispatch has been developed in [19] and analyzed for islanded microgrid performance. This paper analyzes the effect of this algorithm on islanded microgrids along with reactive power compensation which has not been carried out by other researchers to the best of authors' knowledge.

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REFERENCES

[1] D. Liu, Y. Cai, “Taguchi method for solving the economic dispatch problem with nonsmooth cost functions”, IEEE Trans. Power Syst., vol. 20, no. 4, pp. 2006–2014, Nov. 2005.

[2] J. B. Park, Y. W. Jeong, J. R. Shin, K. Lee, “An improved particle swarm optimization for nonconvex economic dispatch problems”, IEEE Trans. Power Syst., vol. 25, no. 1, pp. 156–166, Feb. 2010.

[3] T. Guo, M. Henwood, M. Van Ooijen, “An algorithm for combined heat and power economic dispatch”, IEEE Trans. Power Syst., vol. 11, no. 4, pp. 1778–1784, Nov. 1996.

[4] J. Y. Fan, L. Zhang, “Real time economic dispatch with line flow and emission constraints using quadratic programming”, IEEE Trans. Power Syst., vol. 13, no. 2, pp. 320–325, May 1998.

[5] R. Olfati-Saber, R. M. Murray, “Consensus problems in networks of agents with switching topology and time-delays”, IEEE Trans. Autom. Control, vol. 49, no. 9, pp. 1520-1533, 2004.

[6] W. Ren, R. W. Beard, E. M. Atkins, “Information consensus in multivehicle cooperative control”, IEEE Control Syst. Mag., pp. 71-82, Apr. 2007.

[7] A. Jadbabaie, J. Lin, A. S. Morse, “Coordination of groups of mobile autonomous agents using nearest neighbor rules”, IEEE Trans. Autom. Control, vol. 50, no. 2, pp. 169-182, 2005.

[8] L. Moreau, “Stability of multiagent systems with time-dependent communication links”, IEEE Trans. Autom. Control, vol. 50, no. 2, pp. 169-182, 2005.

[9] Ma, Zhang, Liu, Yang, “Fully distributed social welfare optimization with line flow constraint consideration”, IEEE Trans. Ind. Informat, vol. 11, no. 6, pp. 1532-1540, 2015.

[10] Rahbari, Ojha, Zhang, Chow, “Incremental welfare consensus algorithm for cooperative distributed generation/demand response in smart grid”, IEEE Trans. Smart Grid, vol. 5, no. 6, pp. 2836-2845, 2014.

[11] Xu, Li, “Distributed optimal resource management based on consensus algorithm in a microgrid”, IEEE Trans. Ind. Electron, vol. 62, no. 4, pp. 2584-2592, 2015.

[12] Xu, Yang, Gu, Li, Deng, “Robust real-time distributed optimal control based energy management in a smart grid”, IEEE Trans. Smart Grid, vol. 8, no. 4, pp. 1568-1579, 2017.

[13] Zheng, Wu, Zhang, Lin, “Distributed optimal residential demand response considering operational constraints of unbalanced distribution networks”, IET Generation, Transmission & Distribution, vol. 12, no. 9, pp. 1970-1979, 2018.

[14] Guo, Wen, Li, “Distributed optimal energy scheduling based on a novel PD pricing strategy in smart grid”, IET Generation, Transmission & Distribution, vol. 11, no. 8, pp. 2075-2084, 2017.

[15] Rahbari, Zhang, Chow, “Consensus-based distributed scheduling for cooperative operation of distributed energy resources and storage devices in smart grids”, IET Generation, Transmission & Distribution, vol. 10, no. 5, pp. 1268-1277, 2016.

[16] Abhinav, Schizas, Lewis, Davoudi, “Distributed noise-resilient networked synchrony of active distribution systems”, IEEE Trans. Smart Grid, vol. 9, no. 2, pp. 836-846, 2018.

[17] Abhinav, Schizas, Ferrese, Davoudi, “Optimization based Ac microgrid synchronization”, IEEE Trans. Ind. Informat, vol. 13, no. 5, pp. 2339-2349, 2017.

[18] Dehkordi, Baghaee, Sadati, Guerrero, “Distributed noise-resilient secondary voltage and frequency control for islanded microgrids”, IEEE Trans. Smart Grid, 2018, DOI: 10.1109/TSG.2018.2834951.

[19] F. Chen, M. Chen, Zhao, Guerrero, Wang, “Distributed Noise-resilient economic dispatch strategy for islanded microgrids”, IET Generation, Transmission & Distribution, May 2019, DOI: 10.1049/iet-gtd.2018.5740.

[20] Yazdanian, Mehrizi, Sani, “Distributed control techniques in microgrids”, IEEE Trans. Smart Grid, vol. 5, no. 6, pp. 2901-2909, 2014.

[21] Molzahn, Dorfler, Sandberg, Low, Chakrabarti, Baldick, et al., “A survey of distributed optimization and control algorithms for electric power systems”, IEEE Trans. Smart Grid, vol. 8, no. 6, pp. 2941-2962, 2017.

[22] Han, Zhang, Li, Coelho, Guerrero, “MAS-based distributed coordinated control and optimization in kicrogrid and microgrid clusters: A comprehensive review”, IEEE Trans. Power Electron, vol. 33, no. 8, pp. 6488-6508, 2018.

[23] Xu, Wu, Sun, Wang, “Fully distributed multi-area dynamic economicdispatch method with second-order convergence for active distribution networks”, IET Generation, Transmission & Distribution, vol. 11, no. 16, pp. 3955-3965, 2017.

[24] Lysikatos, Hatziargyriou, “Fully distributed economic dispatch of distributed generators in active distribution networks considering losses”, IET Generation, Transmission & Distribution, vol. 11, no. 3, pp. 627-636, 2017.

[25] Zheng, Wu, Zhang, Li, Liu, “Fully distributed multi-area economic dispatch method for active distribution networks”, IET Generation, Transmission & Distribution, vol. 9, no. 12, pp. 1341-1351, 2015.

[26] Bansal, “Three phase self excited induction generators: An overview”, IEEE Transaction on energy conversion, vol. 20, no. 2, pp. 292-299, 2005.

[27] Dong Lee, Wang Li, “Small signal stability analysis of an autonomous hybrid renewable energy power generation/energy storage system time domain simulations”, IEEE Transaction for Energy Conversion, vol. 23, no. 1, pp. 311-320, 2008.

[28] Murty, Malik, Tondon, “Analysis of self excited induction generator”, IEE Proceedings C – Generation, Transmission and Distribution, vol. 129, no. 6, pp. 260-265, 1982.

[29] Padiyar, “FACTS controlling in power transmission system and distribution”, New Age International Publishers, 2007.

[30] Mohanty, Viswavandya, Mishra, et al., “An optimized STATCOM controller for voltage stability and reactive power compensation in an isolated microgrid”, IEEE Power, Communication and Information Technology Conference, 201