# Sensor Fault Isolation And Tolerant Control Of Distributed Generation Power Converters In A DC Microgrid

Mohammed Said OUAHABI
*Electrical Engineering Laboratory (LGE), Department of Electrical Engineering, University Mohamed Boudiaf M'sila, M'sila 28000, Algeria*
*mohammedsaid.ouahabi@univ-msila.dz*

Said BARKAT
Electrical Engineering Laboratory (LGE), Department of Electrical Engineering, University Mohamed Boudiaf M'sila, M'sila 28000, Algeria
said.barkat@univ-msila.dz

Abdelhafid BENYOUNES
Electrical Engineering Laboratory (LGE), Department of Electrical Engineering, University Mohamed Boudiaf M'sila, M'sila 28000, Algeria
abdelhafid.benyounes@univ-msila.dz

Syphax IHAMMOUCHEN
*Université de Bejaia, Faculté de Technologie, Laboratoire de Technologie Industrielle et de l'Information, 06000 Bejaia, Algeria*
*syphax.ihammouchen@univ-bejaia.dz*

Mourad ZEBBOUDJ
Université de Bejaia, Faculté de Technologie, Laboratoire de Technologie Industrielle et de l'Information, 06000 Bejaia, Algeria
mourad.zebboudj@univ-bejaia.dz

***Abstract*—With the widespread use of DC Microgrid, operation safety is important factor that requires careful consideration. Indeed, unexpected sensor faults can seriously affect the Microgrid stability, which highly impairs the system performance if they are not compensated. This paper aims to increase the reliability of a DC Microgrid by isolating and tolerating sensor faults at the primary level of DC-DC converters, operated in a decentralized DC Microgrid without the use of communications. The simultaneous fault isolation and mitigation are based on a single sliding mode observer. To verify the effectiveness of this approach, a simulation of a DC Microgrid with multiple distributed generation units subjected to faulty sensors is implemented in Matlab/Simulink. The obtained results validate the ability of the proposed method to isolate and tolerate sensor faults.**

***Keywords*—*DC Microgrids, Fault-tolerant control, Sliding mode observer, Sensor fault, Fault detection, Fault isolation.***

## I. INTRODUCTION

DC Microgrids (MGs), which typically consist of multiple distributed generation units, energy storage systems, and loads, are increasingly being adopted in a wide range of applications such as commercial and residential settings, as well as electrified transportation including electric vehicles and ships .[1] [2]. This is mainly attributed to their high efficiency, low cost, and ease of deployment, alongside enhanced flexibility. Such interest has given considerable momentum to the design of flexible and robust control strategies [3]. The primary objectives in controlling DC MGs are stability, voltage regulation, and power sharing. The evolution of control strategies has progressed from centralized and decentralized approaches toward fully distributed schemes [4] [5]. However, the growing interest in flexible and reliable control strategies for DC MGs is largely driven by their increasing implementations, which necessitates enhanced operational safety, reliability, and effective fault detection in the event of failures or anomalies. To improve reliability, it is crucial to minimize communication links, making decentralized control strategies particularly advantageous, as they do not require communication between local controllers of distributed generation units (DGUs), as communication-based control can be vulnerable to cyber-attacks and costly communication [6] [7]. Among these, primary droop control has emerged as a widely adopted decentralized strategy, effectively performing simultaneous voltage regulation and power sharing [8]. On the other hand, regardless of the control structure employed, sensors are vital in the operation of DC MGs, providing essential feedback for the various control systems, making their measurement accuracy critical. Erroneous sensor measurements can lead to diminished control performance, instability, component damage, improper triggering of protection mechanisms, and jeopardize the operation of the entire distributed generation system [9] [10]. Consequently, there is a pressing need for fast and accurate fault identification and fault-tolerant control methods to address these challenges. Motivated by this, increasing researchers have begun to focus on fault diagnosis and fault tolerance control. In [11], the authors introduced a model predictive control with a novel dual extended Kalman filter to tolerate sensor fault in a centralized DC MG. However, both MPC and EKF suffer from high computational burden. In [12], a hybrid fault-tolerant control was proposed, taking advantage of sliding mode observer and hardware redundancy. However, integrating extra hardware can significantly increase costs, which may influence the applicability of the solution for industrial use. In [13] a

979-8-3315-6334-9/25/$31.00 ©2025 IEEE

distributed sensor fault tolerant control was proposed for the power line of a DC MG. The proposed method relies on the integrity of information exchange, which can be prone to noise, delay, or cyber-attacks. Additionally, the method assumes the non-faulty sensors of the power converters of each DGU. In [14], a decentralized sensor fault tolerant control scheme was designed using a residual-based fault detection (FD) logic to locate and tolerate the faulty sensor. However, the scheme cannot handle the occurrence of simultaneous sensor faults. Hence, this paper proposes an SMO with an augmented state to isolate and tolerate sensor faults in real-time at the level of a DGU power converter in DC MG systems. To improve the operational integrity and reliability of decentralized DC Microgrid by addressing the voltage and current sensor faults in the power converter of a DGU aiming to effectively handle the sensor faults using a singular SMO even if the fault co-occurs in voltage and inductor current sensors.

The rest of the paper is structured as follows. Section II outlines the modeling framework and baseline control. Section III describes the fault isolation and tolerance strategy. Section IV reports the results and discussion, and Section V provides the conclusion.

## II. MODELING AND CONTROL

Typical topology of DC MG constructed by connecting i distributed generation unit (DGUs), and different loads connected to a common DC bus as shown in Fig.1. Considering that, a DGU consists of a DC source and buck converter. Although the system is simple in structure, it is widely used in more electric aircraft, more electric ships and other fields [15] [7] [16].

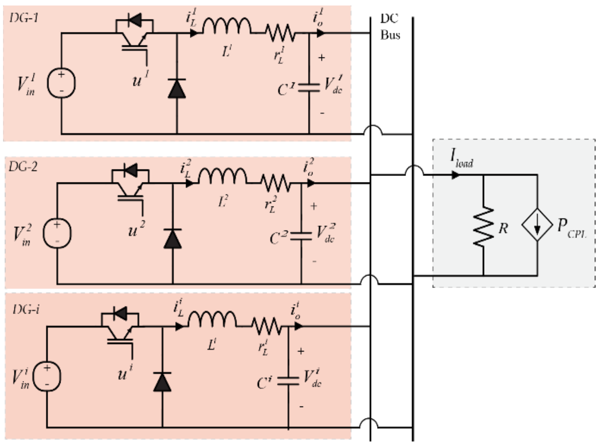


*Fig 1. An islanded DC Microgrid with i distributed generator.*

According to Fig. 1, DGU converters can be modelled using the average state space model as:

$$\begin{aligned} \frac{dV_{dc}^i(t)}{dt} &= \frac{i_L^i(t)}{C^i} - \frac{1}{C^i} i_o^i(t) \\ \frac{di_L^i(t)}{dt} &= \frac{V_{in}^i}{L^i} u^i(t) - \frac{V_{dc}^i(t)}{L^i} - \frac{r_L^i}{L^i} i_L^i(t) \end{aligned} \quad (1)$$

Where common DC bus voltage $V_{dc}^i$ and inductor current $i_L^i(t)$ of each DGU are the measurable state variables of the system, $u^i(t)$ is the duty cycle, $V_{in}$ is the input voltage, and $i_o^i$ is the load current shared by the DG-*i*.

The dynamics of each converter can be rewritten as follows:

$$\begin{aligned} \dot{x}^i(t) &= \bar{A}^i x^i(t) + \bar{B}^i u^i(t) \\ y^i(t) &= \bar{C}^i x^i(t) \end{aligned} \quad (2)$$

Where $x^i(t) = \begin{bmatrix} x_{dc}(t) & x_2^i(t) \end{bmatrix} = \begin{bmatrix} V_{dc}^i(t) & i_L^i(t) \end{bmatrix}$ and

$$A = \begin{bmatrix} 0 & \frac{1}{C} \\ -\frac{1}{L} & \frac{r}{L} \end{bmatrix}, B = \begin{bmatrix} 0 \\ \frac{V_{in}}{L} \end{bmatrix}, E = \begin{bmatrix} -\frac{1}{C} \\ 0 \end{bmatrix}$$

This paper aims to regulate the output voltage to its desired reference in the presence of a single and/or simultaneous sensor fault. The primary control for the islanded DC MG encompasses voltage, current, and droop control. To achieve voltage and power sharing, the bandwidth of the inner current loop is designed to be higher than the outer voltage loop. For the DG-*i*, the voltage reference $V_{dc}^{dp}$ is obtained from the droop curve:

$$V_{dc}^{dp} = V_{dc}^* - \kappa_i i_o^i \quad (3)$$

Where $V_{dc}^*$ is the voltage reference and $\kappa_i$ is the droop ratio of the DG-*i* influences current sharing by determining the sensitivity of output voltage to changes in load current, thus affecting the equitable distribution of power among distributed generators.

## III. FAULT TOLERANT CONTROL

### A. Sensor faults

In practice, sensors are frequently subjected to various types of faults, which can be classified as catastrophic and wear-out failures. This study specifically focuses on wear-out failures common in control system sensors. From a time dependency perspective, these faults can be categorized into three types: abrupt faults (characterized by step functions), incipient faults (exhibiting drift-like behaviors), and intermittent faults (represented by pulse). From a modeling standpoint, wear-out sensor faults are typically represented in the existing literature as an unknown additive signal [14] [11]. So, the measurement of the system output can be expressed as follows:

$$y^i(t) = \bar{C}^i x^i(t) + \bar{E}^i f_s^i(t) \quad (4)$$

Where $f_s^i(t)$ is the sensor fault of i[th] DG, which is assumed unknown but bounded by a known positive scalar $\left\| f_s^i(t) \right\| \le \lambda^i$. $\bar{E}^i$ represents a distribution matrix that indicates the sensor measurements are prone to possible faults, with the same dimension as the system outputs. Combining with (4), the state space model of the MG under sensor faults can be described as:

$$\dot{x}(t) = \bar{A}x(t) + \bar{B}u(t)$$
$$y(t) = \bar{C}x(t) + \bar{E}f_s(t) \tag{5}$$

*B. Design of the sliding mode observer*

The goal is to design a decentralized sliding mode observer for the adopted DC MG to accurately detect sensor faults despite the inherited uncertainties by adding the system output to the dynamics of the system in order to estimate fault-free states. For this, a new state $\varphi(t)$ is introduced as follows:

$$\dot{\varphi}(t) = -\Upsilon_f \varphi(t) + \Upsilon_f y(t) \tag{6}$$

Where $-\Upsilon$, is a stable matrix. Substituting *y(t)* from (2) yields :

$$\dot{\varphi}(t) = -\Upsilon_f \varphi(t) + \Upsilon_f \bar{C}x(t) + \Upsilon_f \bar{E}f_s(t) \tag{7}$$

The augmented state-space model formed by combining (7) and (5) is expressed as:

$$\overbrace{\begin{bmatrix} \dot{x}(t) \\ \dot{\varphi}(t) \end{bmatrix}}^{\dot{x}_a^i(t)} = \overbrace{\begin{bmatrix} \bar{A} & 0 \\ \Upsilon_f \bar{C} & -\Upsilon_f \end{bmatrix}}^{A^i} \overbrace{\begin{bmatrix} x(t) \\ \varphi(t) \end{bmatrix}}^{x^i(t)} + \overbrace{\begin{bmatrix} \bar{B} \\ 0 \end{bmatrix}}^{B^i} u^i(t) + \overbrace{\begin{bmatrix} 0 \\ \bar{E} \end{bmatrix}}^{E^i} f_s^i(t) \tag{8}$$

$$y^i(t) = \begin{bmatrix} 0 & I \end{bmatrix} \begin{bmatrix} x^i(t) \\ \varphi^i(t) \end{bmatrix} \tag{9}$$

Notice that $\varphi(t)$ is a (measurable) output of a 'fictitious' system. To design the observer, the following conditions should be met [17, 18]:

*A1.* $rank(C^i E^i) = rank(E^i)$

*A2. The pair* $(A^i, C^i)$ is observable

It follows from the assumption *A2* that there exists a matrix $\Gamma^i$ with appropriate dimensions such that $\Gamma^i - A^i C^i$ is stable, thus for any $Q^i > 0$ the Lyapunov equation:

$$(\Gamma^i - A^i C^i)^T P^i + P^i(\Gamma^i - A^i C^i) < Q^i \tag{10}$$

has a unique solution $P^i > 0$. And from *A 1*, there exists an arbitrary matrix F such that:

$$E^{iT} P = F^i C \tag{11}$$

Based on the augmented system (8), the following SMO is designed:

$$\dot{\hat{x}}_a^i(t) = A^i \hat{x}_a^i(t) + B^i u^i(t) + \Gamma^i e_y^i(t) + E^i v^i$$
$$\hat{y}^i(t) = C^i \hat{x}_a^i(t) \tag{12}$$

Where $e_y^i(t) = y^i(t) - \hat{y}^i(t)$ is the output estimation error, $\Gamma^i$ is a design parameter that must be selected to satisfy (10) to ensure the convergence of the observer. The discontinuous vector $v^i$ is defined by:

$$v^i = \begin{cases} \rho \dfrac{F^i C^i e_y^e(t)}{\left\| F^i C^i e_y^e(t) \right\|} & if\ y - \hat{y} \neq 0 \\ 0 & otherwise \end{cases} \tag{13}$$

Where $\rho$ is a positive scalar to be determined later.

Define the state estimation errors $e^i(t) = x^i(t) - \hat{x}^i(t)$, then the error dynamics after the occurrence of sensor faults can be obtained using (8) and (12) as follows:

$$e^i(t) = (A^i - \Gamma^i C^i) e_y^i(t) + E^i(f_s^i - v^i) \tag{14}$$

We consider the Lyapunov function as:

$$V^i(e^i) = e^{iT} P^i e^i \tag{15}$$

The time derivative of $V^i(e^i)$ along the trajectories of the system is equal to:

$$\dot{V}^i(e^i) = e^{iT}\left( (A^i - \Gamma^i C^i)^T P^i + P^i (A^i - \Gamma^i C^i) \right) e^i$$
$$-2e^{iT} P^i E^i v^i + 2e^{iT} P^i E^i f_s^i \tag{16}$$

From the (10) and setting $Q^i$ to identity matrix $I$ with appropriate dimensions in (16) yield:

$$\dot{V}^i(e^i) \leq 2\left\| E^{iT} P^i e_y^i(t) \right\| (\lambda - \rho) \tag{17}$$

By setting $\rho > \left| \lambda^i \right|$, it results $\dot{V}^i < 0$, which proves the state estimation error is stable. The value of $\lambda$ should be determined according to the fault magnitude $\left\| f_s^i(t) \right\| \leq \lambda^i$

*C. Sensor fault isolation and control reconfiguration*

The sensor fault isolation is achieved through an evaluation of the residual of the sensor measurement and fault-free estimate of the corresponding sensor. The current and voltage residuals are defined by:

$$r_i = \left| \hat{i}_L - i_L \right| \ ; \ r_v = \left| \hat{V}_{dc} - V_{dc} \right| \tag{18}$$

In order to detect the sensor fault, the residual signal is compared to a constant predetermined threshold value as in (19). Whenever the error exceeds a threshold value then it is considered a fault; this can be summarized by the following logic:

$$\begin{cases} r_i \geq J_i^{th} \rightarrow fault \\ r_i \leq J_i^{th} \rightarrow no-fault \end{cases} \quad \begin{cases} r_v \geq J_V^{th} \rightarrow fault \\ r_v \leq J_v^{th} \rightarrow no-fault \end{cases} \tag{19}$$

where $J_i^{th}$ and $J_V^{th}$ are the constant thresholds for the current and voltage residuals, respectively, which are set at 5% of the nominal values of the respective sensor's measurements. The current and voltage sensors are continuously monitored for faults. When a fault is detected in any current sensor, the current feedback is automatically sourced from the observer. Likewise, if any voltage sensor fails, it is disregarded, and the required voltage is obtained from the observer. The proposed sensor fault-tolerant control (SFTC) strategy is depicted in Fig. 2.

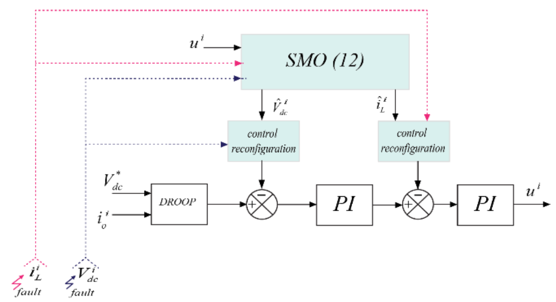


Fig 2. Proposed sensor Fault Tolerant Control Strategy

## IV. SIMULATION RESULTS

To validate the effectiveness of the proposed sensor fault-tolerant control strategy, the test model depicted in Fig. 1 is built in *MATLAB/Simulink*, comprising three DGUs. Each unit is equipped with the proposed SFTC (Fig. 2) to ensure proper voltage regulation and current sharing. The simulation step is set at *10µs* and switching frequency of *40 kHz*. The parameters of the model are detailed in Table I.

Two simulation scenarios are addressed to evaluate the proposed strategy. In the first scenario, the SFTC will be deactivated, and in the second, it will be activated. For brevity, the sensor faults are considered to occur on the voltage and current sensor of DG-*1*. In both scenarios, an abrupt sensor fault $f_s^1(t)=8$ and $f_s^1(t)=2$ are applied to the voltage and current sensors of DGU1 at *t=0.6s* and *t=0.9s*, respectively. To further verify the robustness against load changes, DGUs are connected and operated as a Microgrid at the beginning. The power load $P_{CPL}$ is increased by 50% and decreased back at *t=0.15s* and *t=0.5s*, respectively.

### A. *Performance of the Microgrid without the proposed SFTC*

In this scenario, the performance of the Microgrid with only the baseline controller is observed under faulty voltage and current sensors. The response curves of the measured and SMO based estimated voltages and current dynamics of the DC Microgrid are depicted in Fig .3 and Fig .4, respectively.

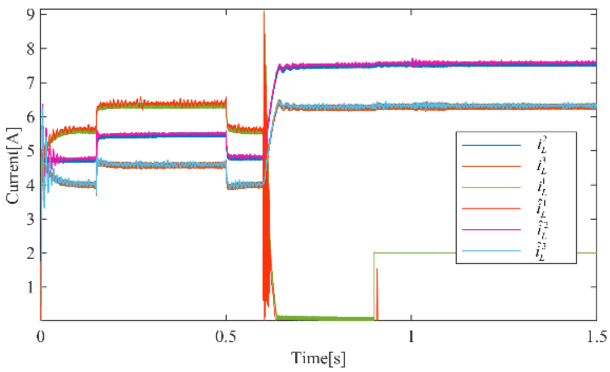

Fig 3. Microgrid measured and observed inductor currents dynamics without FTC.

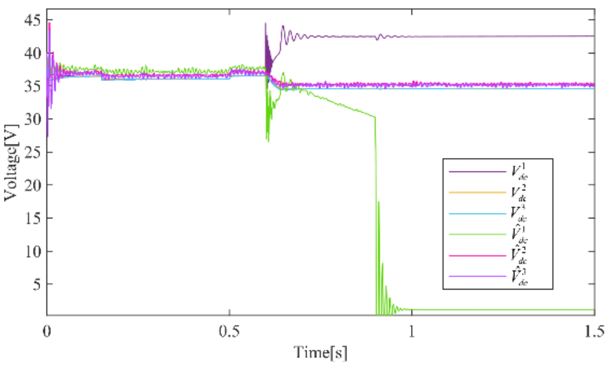

Fig. 4 Microgrid measured and observed output voltages dynamics without FTC.

The figures show that the current sharing and voltage regulation are preserved despite the load variations. However, when the fault occurs in the voltage sensor, the measured inductor current of DGU 1 and its estimate diverge to zero. Thus, the deviation-induced a current demand on the other two DGUs. As a result, the DC Microgrid's stability and functionality are seriously jeopardized. There is also a chance that the increased load current on the DGUs 2 and 3 will blow fuses. This outcome emphasizes how crucial it is to put in place a fault-tolerant control strategy in order to preserve operational integrity.

TABLE I. Systems parameters.

| **Parameters** | **Values** |
|---|---|
| $L^i$ | $7mH$ |
| $C^i$ | $335\mu F$ |
| $r_L^i$ | $0.1m\Omega$ |
| $V_{in}^i$ | $V_{in}^1=100V$ $V_{in}^2=80V$ $V_{in}^3=120V$ |
| $R$ | $3\Omega$ |

### B. *Performance of the Microgrid with the proposed SFTC*

When a sensor failure is identified, the suggested sensor FTC technique takes effect and reconfigures the control. The results of the fault flags and the response curves of the measured and observed voltages and currents dynamics of the DC Microgrid are depicted in Figs .5, 6, and 7, respectively.

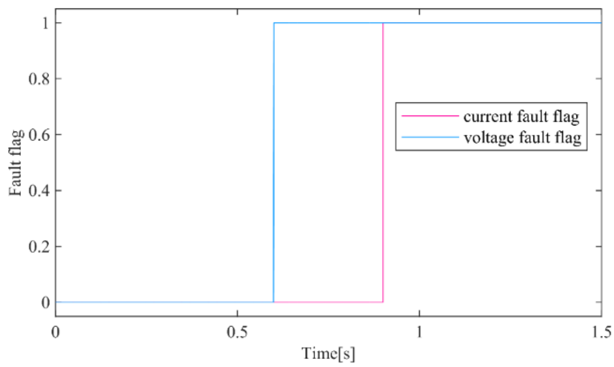

Fig 5. Voltage and current fault flags of DGU 1.

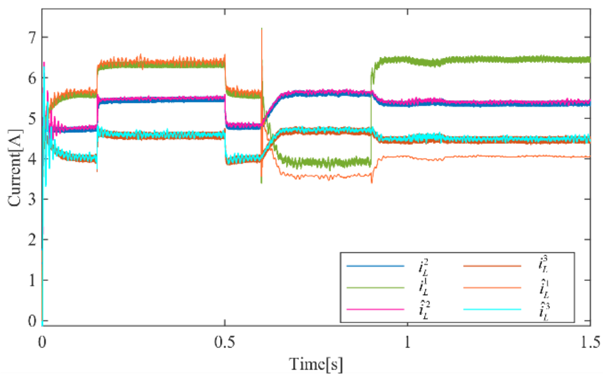

Fig 6. Microgrid measured and observed inductor currents dynamics.

As depicted by Fig. 5, the fault flag accurately identifies faults in voltage and current sensors without triggering false alarms due to load variations. This demonstrates the effectiveness of the proposed methods in reliably detecting simultaneous sensor faults.

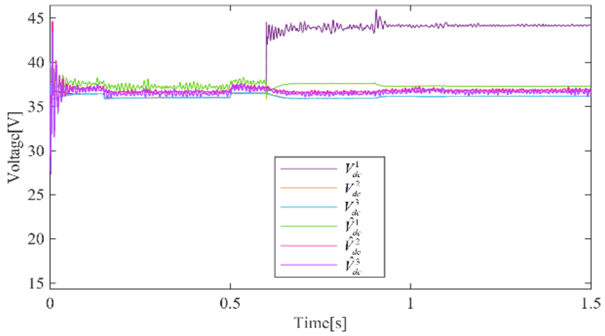


Fig. 7 Microgrid measured and observed output voltages dynamics

Fig. 6 and Fig .7 illustrate the current and voltage responses under the proposed SFTC. Although degraded performance due to sensor faults, the strategy successfully isolates and reconfigures the controller, ensuring system stability, and maintaining both voltage regulation and current sharing under fault conditions.

## V. CONCLUSION

In this paper, a fault isolation and tolerance control strategy based on an SMO is proposed for a DC Microgrid system with voltage and current sensor faults in the distributed generator converter level. After establishing the faulty model of the power converter, an augmented SMO is designed to decouple the sensor fault using a new filtered state of the measurement. Based on this, a fault-tolerant control is achieved so that the DC Microgrid operates under faulty sensors. Simulation results verify the effectiveness of the proposed strategy.

## REFERENCES


[1] Y. Zeng, Q. Zhang, Y. Liu, H. Guo, F. Zhang, and S. You, "Distributed unified controller design for parallel battery storage system in DC shipboard microgrid," *IEEE Transactions on Power Systems,* vol. 39, no. 1, pp. 546-563, 2023.

[2] M. M. Mahfouz and M. R. Iravani, "Grid-integration of battery-enabled DC fast charging station for electric vehicles," *IEEE Transactions on Energy Conversion,* vol. 35, no. 1, pp. 375-385, 2019.

[3] T. Dragičević, X. Lu, J. C. Vasquez, and J. M. Guerrero, "DC microgrids—Part II: A review of power architectures, applications, and standardization issues," *IEEE transactions on power electronics,* vol. 31, no. 5, pp. 3528-3549, 2015.

[4] Z. Chen, X. Yu, W. Xu, and G. Wen, "Modeling and control of islanded DC microgrid clusters with hierarchical event-triggered consensus algorithm," *IEEE Transactions on Circuits and Systems I: Regular Papers,* vol. 68, no. 1, pp. 376-386, 2020.

[5] M. Tucci, S. Riverso, J. C. Vasquez, J. M. Guerrero, and G. Ferrari-Trecate, "A decentralized scalable approach to voltage control of DC islanded microgrids," *IEEE Transactions on Control Systems Technology,* vol. 24, no. 6, pp. 1965-1979, 2016.

[6] S. Zuo, T. Altun, F. L. Lewis, and A. Davoudi, "Distributed Resilient Secondary Control of DC Microgrids Against Unbounded Attacks," *IEEE Transactions on Smart Grid,* vol. 11, no. 5, pp. 3850-3859, 2020, doi: 10.1109/tsg.2020.2992118.

[7] D. Zhou, Q. Zhang, F. Guo, Z. Lian, J. Qi, and W. Zhou, "Distributed resilient secondary control for islanded DC microgrids considering unbounded FDI attacks," *IEEE Transactions on Smart Grid,* vol. 15, no. 1, pp. 160-170, 2023.

[8] S. Bahrami, S. S. Mousavi, and M. Shafiee-Rad, "Decentralized Adaptive Nonlinear Controller for Voltage Regulation of Output-Constrained DC Microgrids with ZIP Loads," *IEEE Transactions on Power Systems,* 2024.

[9] T. Wang *et al.*, "Model-Based Fault Detection and Isolation in DC Microgrids Using Optimal Observers," *IEEE Journal of Emerging and Selected Topics in Power Electronics,* vol. 9, no. 5, pp. 5613-5630, 2021, doi: 10.1109/jestpe.2020.3045418.

[10] T. Wang, L. Liang, Z. Hao, A. Monti, and F. Ponci, "LPV Model-Based Fault Detection and Isolation in DC Microgrids Through Signature Recognition," *IEEE Transactions on Smart Grid,* vol. 14, no. 4, pp. 2558-2571, 2022.

[11] N. Vafamand, M. M. Arefi, M. H. Asemani, M. S. Javadi, F. Wang, and J. P. Catalão, "Dual-EKF-based fault-tolerant predictive control of nonlinear DC microgrids with actuator and sensor faults," *IEEE Transactions on Industry Applications,* vol. 58, no. 4, pp. 5438-5446, 2022.

[12] M. V. S. S. Chandra and S. Mohapatro, "Hybrid Sensor Fault Tolerant Control of Low Voltage DC Microgrid," *IEEE Transactions on Industry Applications,* vol. 60, no. 1, pp. 1705-1715, 2024, doi: 10.1109/tia.2023.3315276.

[13] M. Huang, L. Ding, W. Li, C.-Y. Chen, and Z. Liu, "Distributed observer-based H∞ fault-tolerant control for DC microgrids with sensor fault," *IEEE Transactions on Circuits and Systems I: Regular Papers,* vol. 68, no. 4, pp. 1659-1670, 2021.

[14] K. Wan, J. Zhao, Y. Chen, and M. Yu, "A Decentralized Resilient Control Scheme for DC Microgrids Against Faults on Sensor and Actuator," *IEEE Transactions on Circuits and Systems I: Regular Papers,* vol. 71, no. 2, pp. 816-827, 2024, doi: 10.1109/tcsi.2023.3331881.

[15] F. Gao, S. Bozhko, G. Asher, P. Wheeler, and C. Patel, "An improved voltage compensation approach in a droop-controlled DC power system for the more electric aircraft," *IEEE Transactions on Power Electronics,* vol. 31, no. 10, pp. 7369-7383, 2015.

[16] K. Wan, Y. Chen, J. Zhao, and M. Yu, "A Decentralized Fault-Tolerant Control for DC Microgrids Against Disturbances and Actuator Faults," *IEEE Transactions on Smart Grid,* vol. 14, no. 4, pp. 2534-2544, 2023, doi: 10.1109/tsg.2022.3229057.

[17] J. Xia, Z. Li, X. Gao, Y. Guo, and X. Zhang, "Real-time sensor fault identification and remediation for single-phase grid-connected converters using hybrid observers with unknown input adaptation," *IEEE Transactions on Industrial Electronics,* vol. 70, no. 3, pp. 2407-2418, 2022.

[18] H. Alwi, C. Edwards, and C. P. Tan, *Fault detection and fault-tolerant control using sliding modes*. Springer, 2011.

IEEE ALGERIA SECTION

M'SILA UNIVERSITY IEEE STUDENT BRANCH

IEEE Photonics Society ALGERIA CHAPTER

كلية التكنولوجيا FACULTY OF TECHNOLOGY

LGE Laboratoire de génie électrique

1985 جامعة محمد بوضياف - المسيلة Université Mohamed Boudiaf - M'sila

# Certificate of Participation

This is to certify that:

## Mohammed Said Ouahabi

Participated in the "*The 2nd International Conference of Advanced Technology in Electronic and Electrical Engineering (ICATEEE2025)" held from December 10-11, 2025, at University of M'Sila, Algeria*" with a presentation entitled:

***Sensor Fault Isolation And Tolerant Control Of Distributed Generation Power Converters In A DC Microgrid***

**Co-authors:** Said Barkat, Abdelhafid Benyounes, Syphax Ihammouchen, Mourad Zebboudj.

ICATEEE 2025

December 10-11, 2025, at University of M'Sila, Algeria
https://media.univ-msila.dz/ICATEEE25/

Mohamed Boudiaf University - M'sila · The 2nd International Conference of Advanced Technology in Electronic... · ICATEEE2025 · 10th to 11th December 2025 M'sila · Faculty of Technology

*Prof: Ismail GHADBANE*

**General Chair**