Designs 2026 Conference
The 1st International Online Conference on Designs
9–10 February 2026 | Online
MDPI

Optimal Power Sharing Between Multi-Microgrids To Improve Electrical Grid Resilience After Disconnection

Nour ELYakine KOUBA
Faculty of Electrical Engineering, University of Sciences and Technology Houari Boumediene, Algiers, Algeria
E-mail: nourelyakin.kouba@usthb.edu.dz

sciforum-159307

INTRODUCTION & AIM

The main objective of this work was to design an optimal power management and dispatch scheme to enhance electrical grid resilience after disconnection using multi-microgrids. A multi-stage based coordinated strategy was employed involving an optimal power management of renewable sources, optimal sharing of interconnected microgrids, and an intelligent load shedding. Each microgrid includs solar PV generator, concentrating solar power (CSP), and wind farm. Further, a multiple storage devices were installed to support active power control, comprise Redox Flow Batteries (RFB),Superconducting Magnetic Energy Storage (SMES) and Fuel Cells (FC). Moreover, an optimal Load Frequency Control (LFC) loop was applied to cope with system load disturbances or climatic changes. In this aim, an optimal Fuzzy-PIDN controller. was designed using a recently optimization algorithm called Crayfish Optimization Algorithm (COA) , that was used to find the best controller parameters to support the main grid frequency stability and control in case of load disturbances. Several case studies have been conducted to prove the validity of the proposed strategy. It can be concluded from the obtained results, that the mutli-stage optimal power management and control can ensures an optimal sharing between interconnected multi-microgrids to increases resilience and energy autonomy after grid disconnection, also can improve dynamic power system stability.

METHOD

In this part, a multi-microgrids system connected with large power system was presented.an optimal application of load frequency control based on a Fuzzy-PIDN controller was developed. This study has to improve the system stability including renewable energy sources a hybrid storage system.

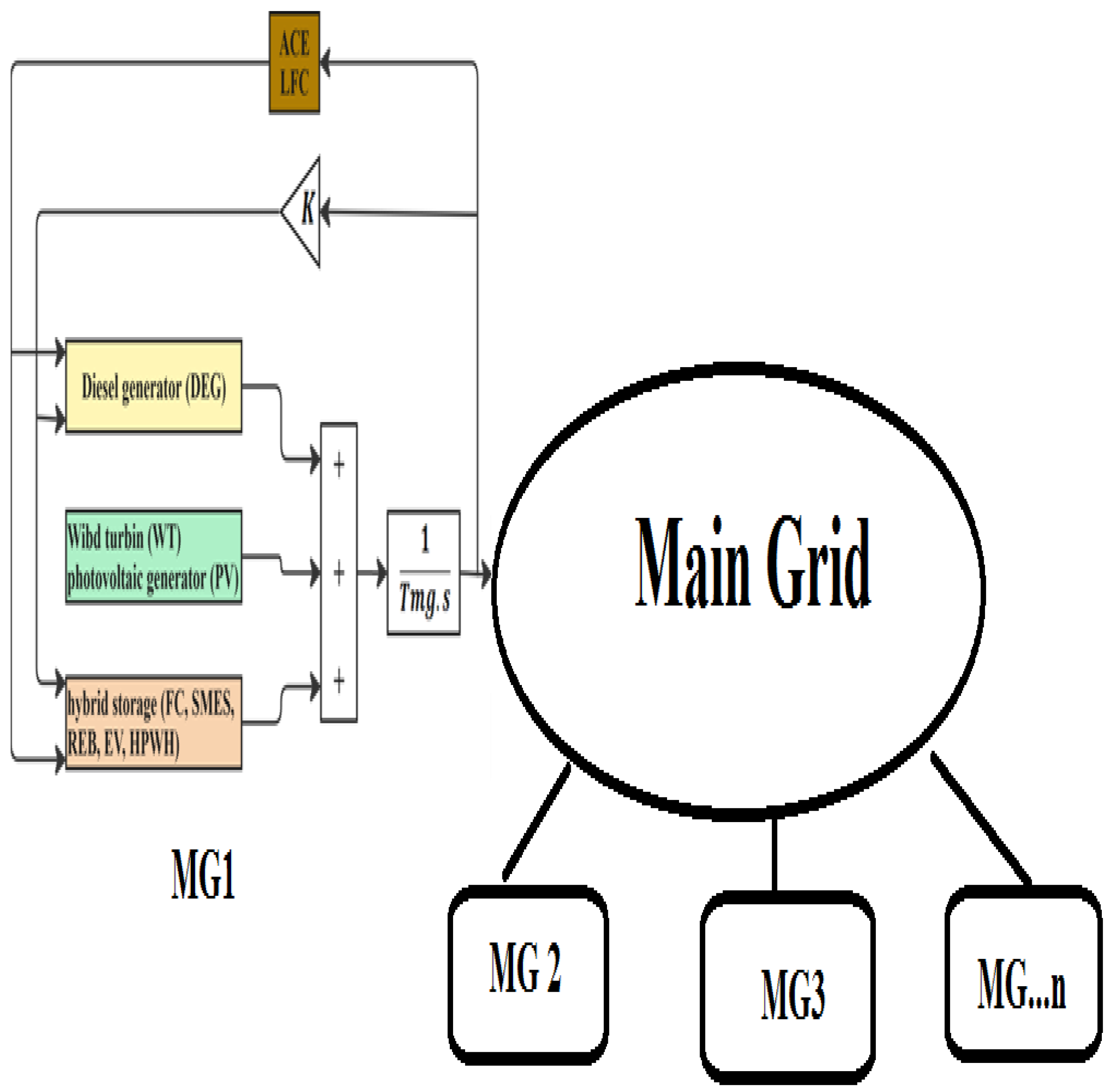

Figure 1 . Proposed Power management and Control Scheme.

RESULTS & DISCUSSION

In this part, a large-scale power system was simulated under overload disturbance conditions with the integration of renewable energy sources. Two case studies were conducted. The first simulation was performed without the connection of the multi-microgrid system. The second simulation was carried out with three interconnected microgrids connected to the main grid. The system frequency was analyzed, and the results are presented in Figures 2 and 3. The results indicate that optimal power sharing among the interconnected microgrids enhances power system resilience and mitigates the adverse impact of renewable energy fluctuations. Also, it can be noticed that the storage system can help conventional system to regulate frequency during fluctuations.

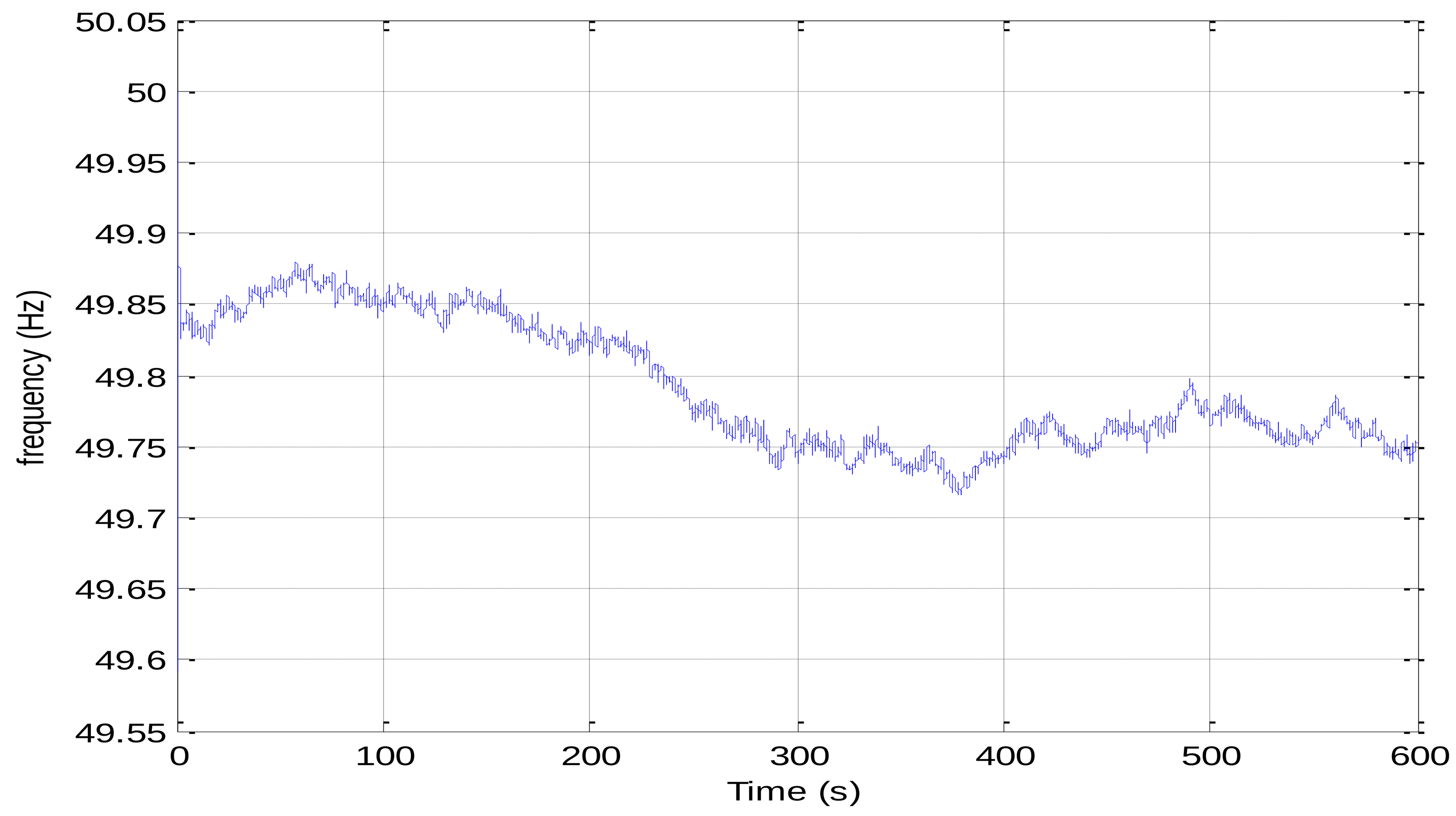

Figure 2 . System Frequency without Micrgrids.

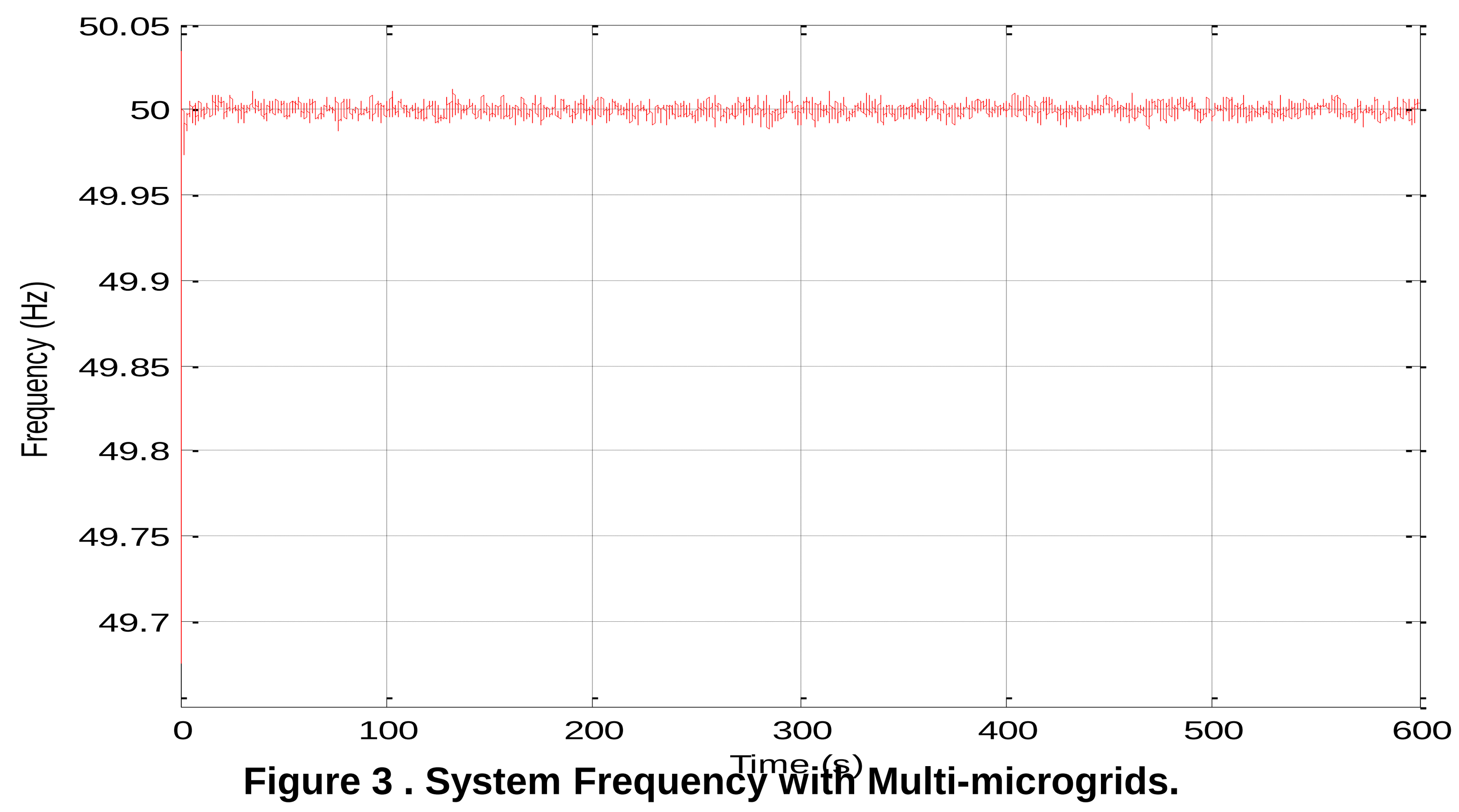

Figure 3 . System Frequency with Multi-microgrids.

CONCLUSION

This paper has analyzed the contribution of using a multi-microgrids to enhance system stability and improve grid resilience after disconnection. The impact of renewable sources was also analyzed. An optimal Fuzzy-PIDN controller based Crayfish Optimization Algorithm (COA) was employed. Further, multi-storage devices have been used to support active power management and control. As perspectives, this work will be extended with the application of an multi-agent system.

FUTURE WORK / REFERENCES

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