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Educational Simulator of Smart Grids

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INTRODUCTION & AIM

This work presents a new power system analysis tool named Educational Simulator of Smart Grids (SESG) for isolated, connected, and interconnected nanogrid and microgrid systems. The SESG is a simulation tool launched through a Matlab application. It is based on theoretical concepts, enabling the modeling of various systems and the implementation of management and optimization techniques for different renewable energy system topologies. The simulations are performed using MATLAB software, where models are developed and simulated. Furthermore, a developed manager is offered to enhance the value of the SESG application in terms of the software, incorporating the creation of a 3D environment. As a result, the observation and management interface will serve as a link between these two aspects. Our work focuses on the optimal management and load balancing of nanogrids connected to Electric Vehicle (EV) stations, and we will integrate all the results into the SESG simulation tool. We introduce the overall graphical interface that we have developed within the SESG application. In addition, we integrated a microgrid system into the SESG simulator to visualize and analyze the dynamic behavior of frequency and power transfer for an isolated and interconnected system with hybrid storage. Our work was based on two topologies: isolated and interconnected.

METHOD

This work focuses on the optimal power management and load balancing of nanogrids connected to Electric Vehicle (EV) stations interconnected with multiple Microgrid system. This main interface of SESG simulator consists of a title and a logo, represented by a navigation button, as illustrated in **Fig 1**. Otherwise, by clicking on this navigation button, the user can access a sub-interface that allows them to choose between different topologies, such as Nanogrid, Microgrid, Connection and website creation. However, our primary interest lies first in the Nanogrid topology and the connection between Nanogrid and Microgrid, and website creation which are accessible via another specific navigation button as shown in **Fig 2**.

Fig.1

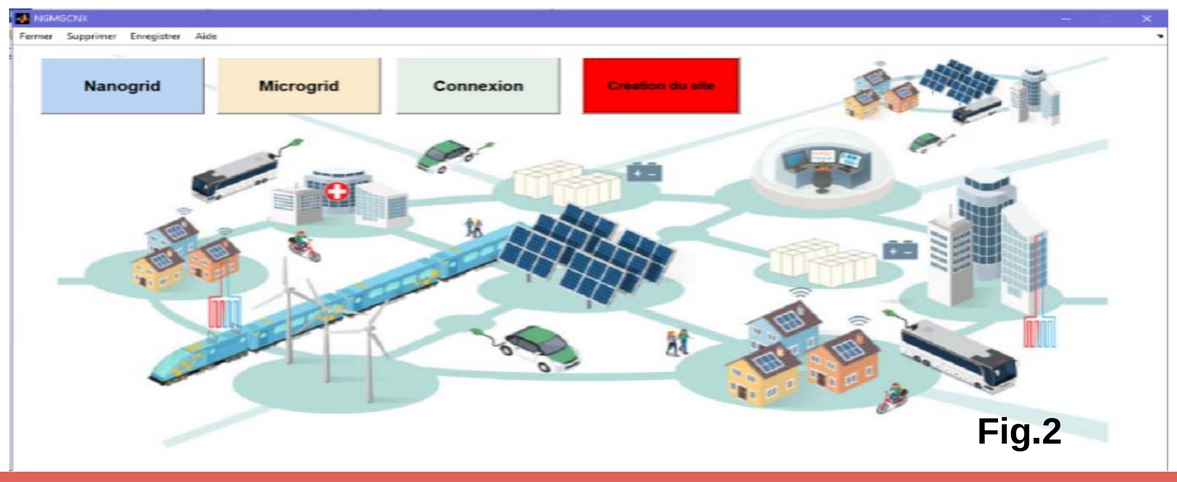
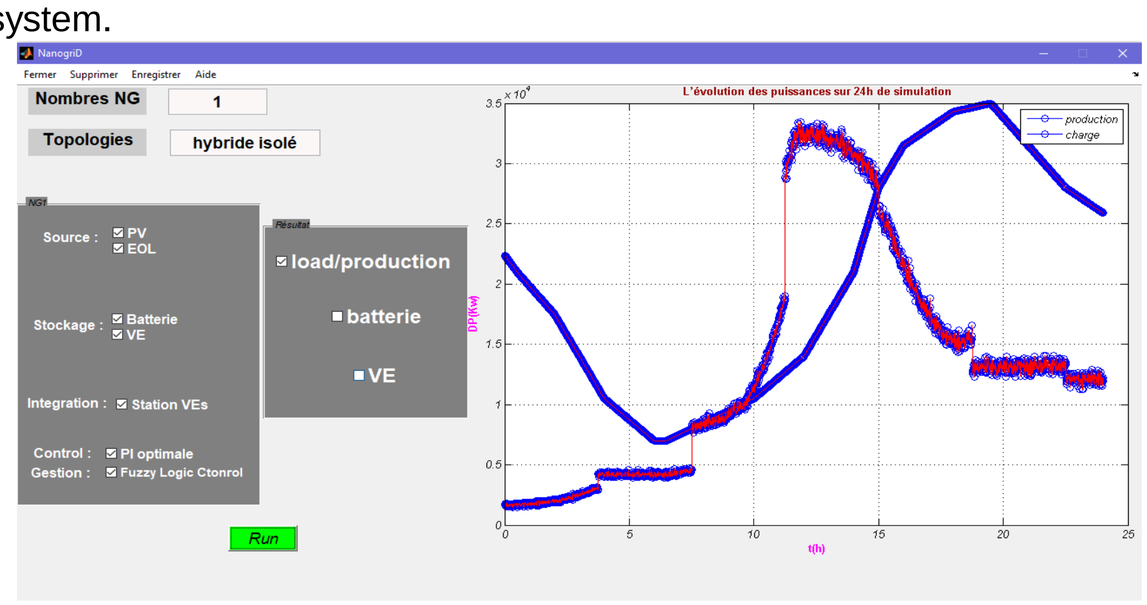


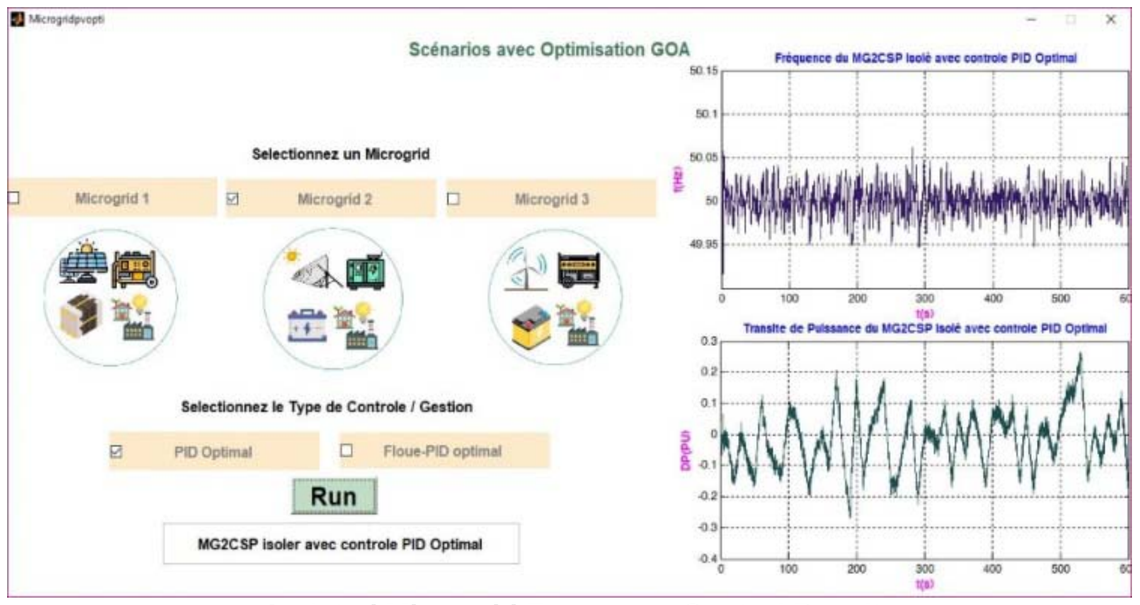
Fig.2

RESULTS & DISCUSSION

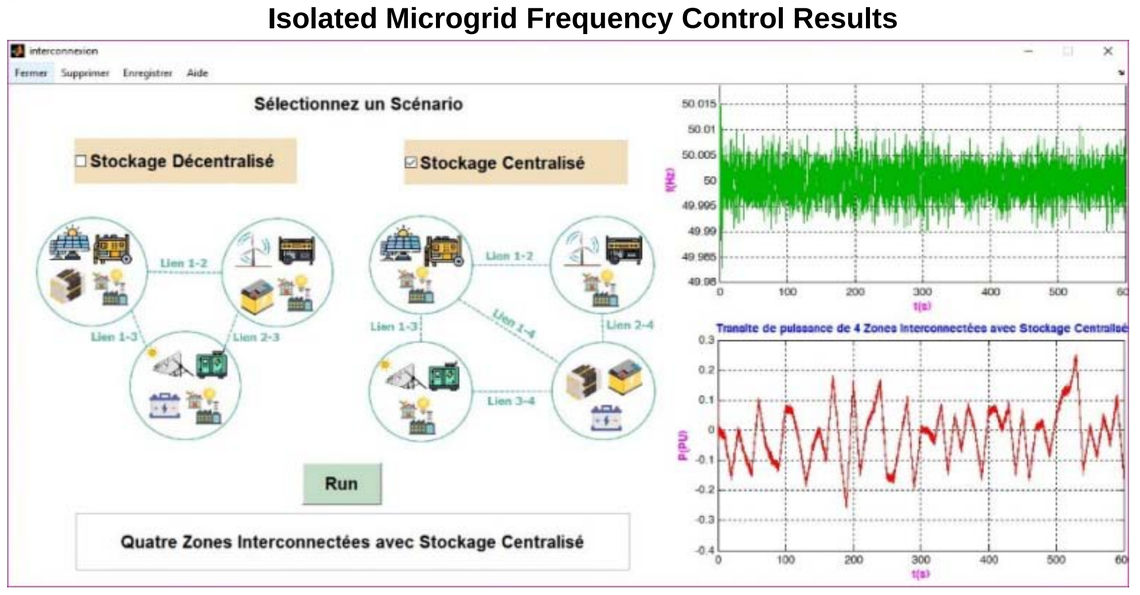
In this section, we provide an example of Isolated Nanogrid (NG), isolated Microgrid (MG), and interconnected NG-MG topology in a hybrid system.



Isolated Hybrid Nanogrid Power Management Results



Isolated Microgrid Frequency Control Results



Interconnected Nanogrid-Microgrid Power Management and Control

CONCLUSION

- In this work, a new power system analysis tool named Educational Simulator of Smart Grids (SESG) for isolated, connected, and interconnected nanogrid and microgrid systems.
- An effective optimal power management and control strategy multi-area interconnected Nanogrid and Microgrids was proposed.
- A novel multi-stage frequency and tie-line control strategy was implemented in coordination with hybrid energy storage system and HVDC transmission link.

REFERENCES

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