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BATTERY ENERGY STORAGE SYSTEM (BESS) MODELING FOR MICROGRID
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Abstract
In the age of technology, microgrids have become well known because of their capability to back up the grid when an unpleasant event is about to occur or during power disruptions, at any time. However, the microgrid will not function well during power disruptions if the controller does not respond fast enough and the BESS will be affected. Many types of controllers can be used for microgrid systems. The controllers may take the form of Maximum Power Point Tracking (MPPT) Controller, Proportional Integral Derivative (PID) Controller, and Model Predictive Controller (MPC). Each of the controllers stated has its functions for the microgrid. However, two controllers that must be considered are PID and MPC. Both controllers will be compared based on their efficiency results which can be obtained through simulations by observing both graphs in charging and discharging states. Most researchers implied that MPC is better than PID because of several factors such as MPC is more robust and stable because of its complexity. Other than that, MPC can handle more inputs and outputs than PID which can cater to one input and output only. Although MPC has many benefits over the PID, still it is not ideal due to its complex algorithm. This work proposed an algorithm of simulations for the MPC to operate to get the best output for microgrid and BESS and compare the performance of MPC with PID. Using Simulink and MATLAB as the main simulation software is a very ideal way to simulate the dynamic performance of MPC. Furthermore, with Simulink, unpredictable variables such as Renewable Energy (RE) sources input and loads demands that are related to MPC can be measured easily. The algorithm of MPC is a cost function. Then the performance of the MPC is calculated using Fast-Fourier Transform (FFT) and Total Harmonic Distortion (THD). Lower THD means a higher power factor, this results in higher efficiency. This paper recorded THD of 9.57% and 12.77% in charging states and 16.51% and 18.15% in discharging states of MPC. Besides, PID recorded THD of 22.10% and 29.73% in charging states and 84.29% and 85.58% in discharging states. All of the recorded THD is below 25% in MPC and it shows a good efficiency while PID's THD is above 25% shows its inefficiency

Author Keywords
battery energy storage system (BESS); maximum power point tracker (MPPT) controller; model predictive controller (MPC); proportional integral derivative (PID) controller

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