ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 10, Iss 1, 2021

In an HRES Grid Connected System, an Intelligent ESA Technique for Optimal Power Quality Enhancement (OPQE)*

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Abstract

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In this way, the production of electric energy is encouraged by the use of renewable energies like wind and sol ar.

However, while adding these renewable energy sources to the electrical system, various problems with power quality may arise.

However, the majority of the techniques in the literature focus on a particular power quality problem caused b y one of the sources.

However, because so many diverse renewable energy sources are now being integrated into the distribution sy stem, the problem with power quality is getting worse.Consequently, the topic of power quality is presented in this study.

Renewable energy resource-based distributed generators are predominantly gaining a lot of importance due to the advancement in technology and environmental concerns due to the huge demand for power to the utility grid

The major contribution of the proposed work is as follows;

- Developed a HRES Grid Connected System with three power sources as Wind, PV and Battery.
- Modelled Extended Search Algorithm for the controlling the system and balance the power qualityissues in terms of current, voltage, and real andreactive power.
- An error value with respect to the current and voltageis formulated as the fitness function for the ESA.

Proposed HRE system with Extended SearchOptimization

Architecture of the Proposed Power Quality Enhancement System[1].

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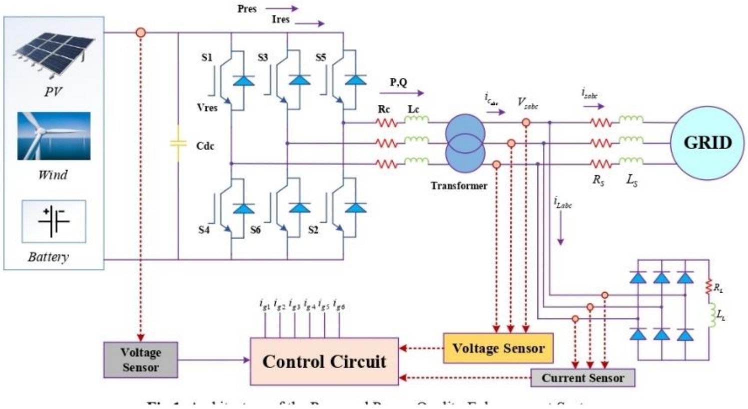
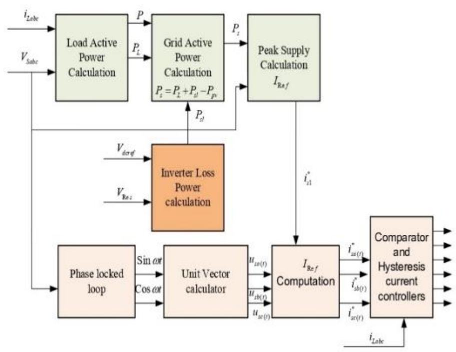
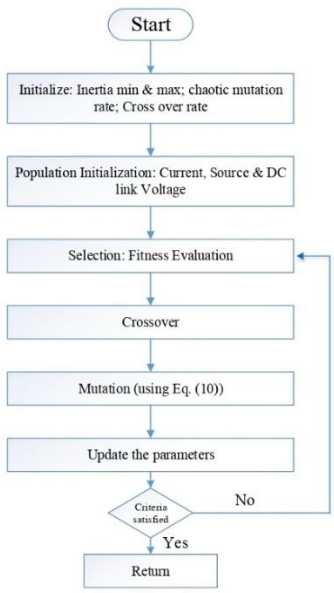


Control diagram



Extended Search Algorithm



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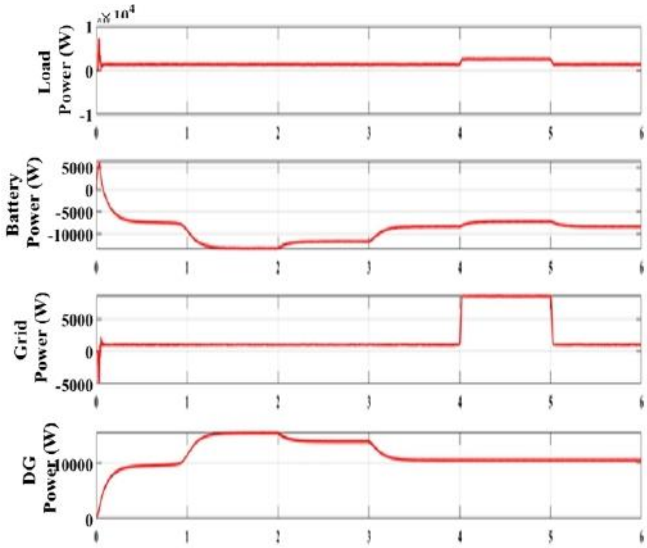
RESULTS AND DISCUSSIONS

The proposed HRES Grid Connected System is evaluatedusing seven cases; such as [2].

- ***Case 1***: Condition for Linear
- ***Case 2***: Condition during step changes for Non-Linear Load
- ***Case 3***: Condition for Unbalanced Non-LinearLoad[3].
- ***Case 4***: Condition for Unbalanced Non-LinearLoad during a step change
- ***Case 5***: Linear Load Variation with ExtendedSearch Algorithm
- ***Case 6***: Linear Un-Balance Load Variation withExtended Search Algorithm
- ***Case 7***: Non-Linear Load Variation withExtended Search Algorithm

CASE-1: Condition for Non-Linear Load

Load demand ,solar power ,grid power ,battery power



Power Factors for Inverter Load Current in Case 1

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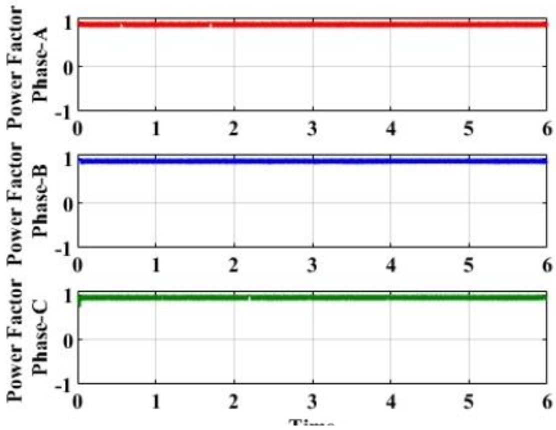
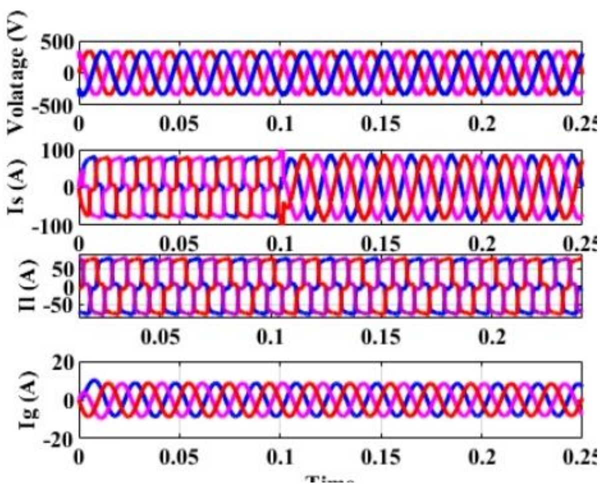
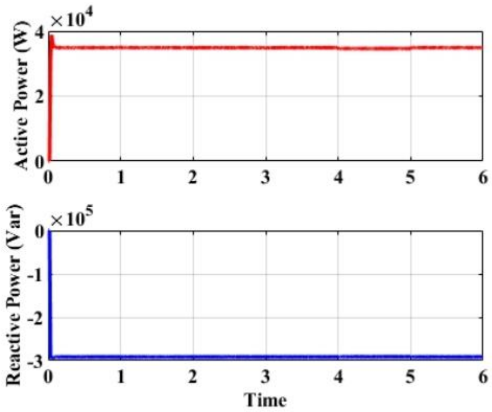


Grid current, Load current, Inverter current, Voltage of Case 1



Active and Reactive Power for Grid load and Source of Cas e 1



Power factor variation of source load voltage and current during changes of load in

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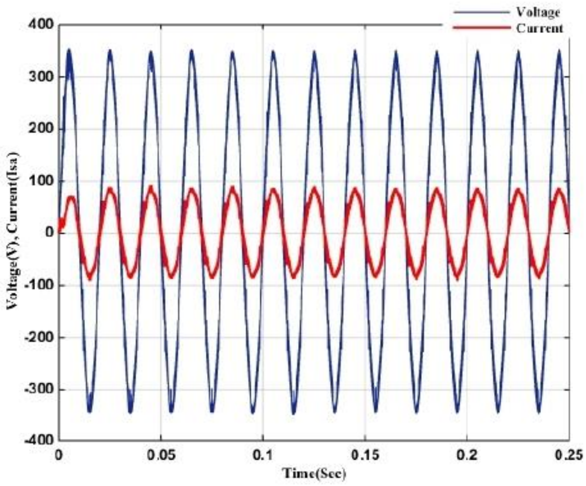
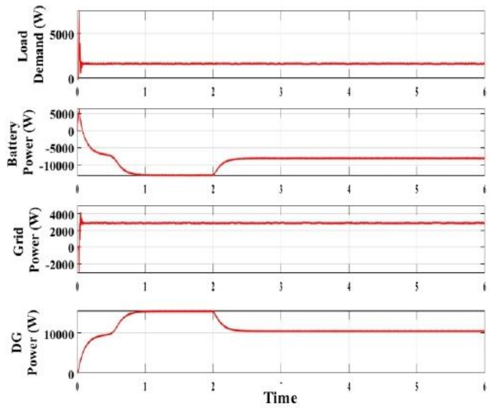
Case 1

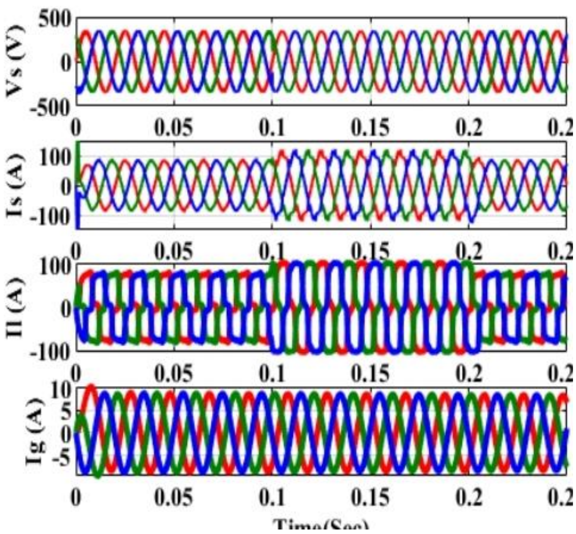


CASE-2: Condition for Non-Linear Load ConditionDuringStep Changes

Load Demand, Solar Power, Grid Power and BatteryPower of Case 2



Power Factors for Inverter Load Current of Case 2



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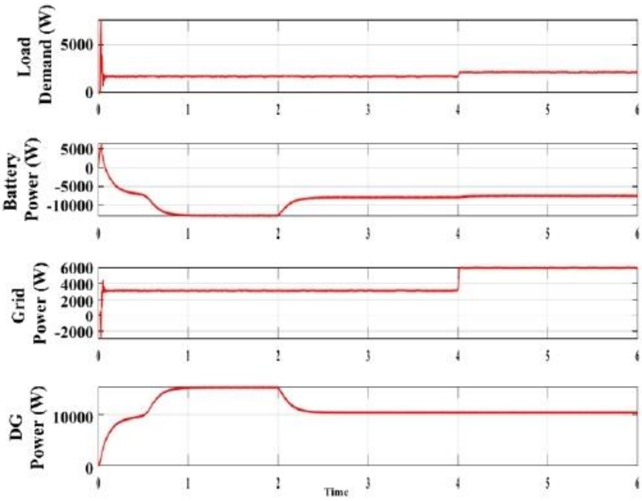
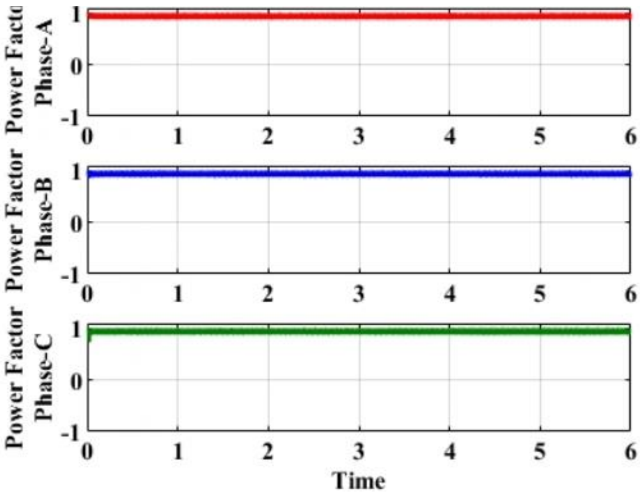
CASE-3: Condition for Non-Linear Load Variation

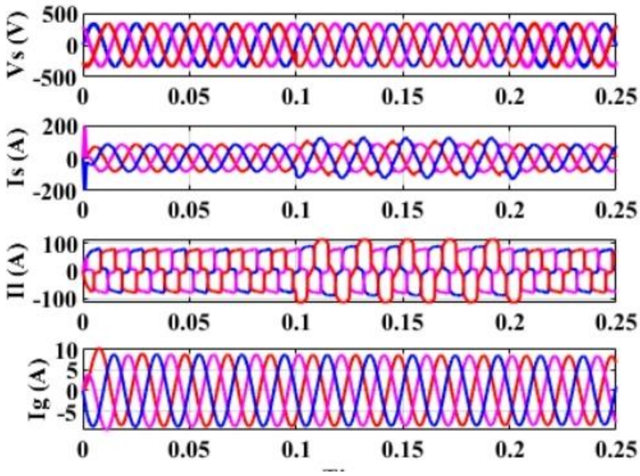
Load Demand, Solar Power, Grid Power and Battery Power in Case 3



Power Factors for Inverter Load Current of case 3



Grid current, Load current, Inverter current, and Voltage signal of case 3



Case 4: Condition for Unbalanced Non-Linear Load during a step change Grid

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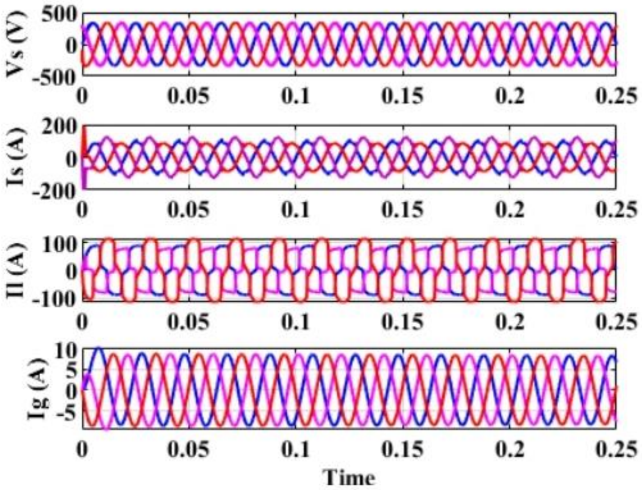
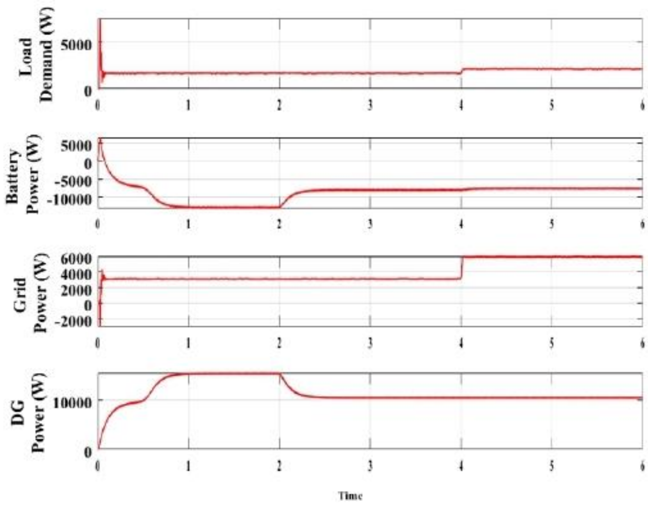
current, Load current, Inverter current andVoltage signal of case 4



Load Demand, Solar Power, Grid Power and BatteryPower in case 4



Case 5: Linear Load Variation with Extended SearchAlgorithm

Power Factors for Inverter Load Current of case

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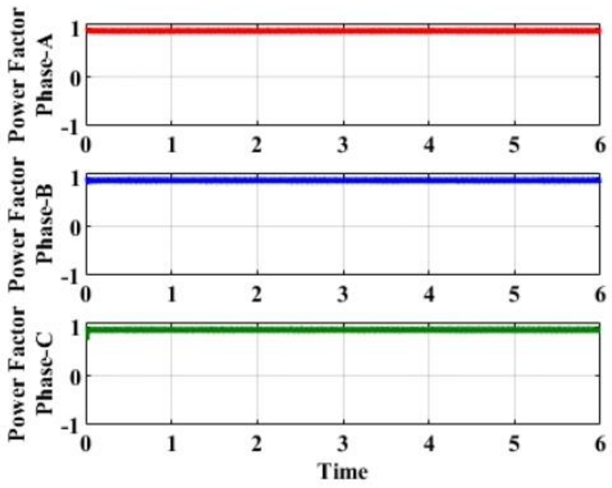
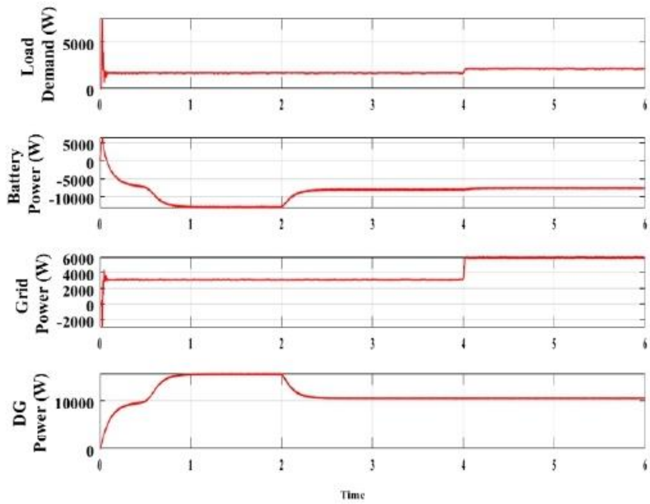
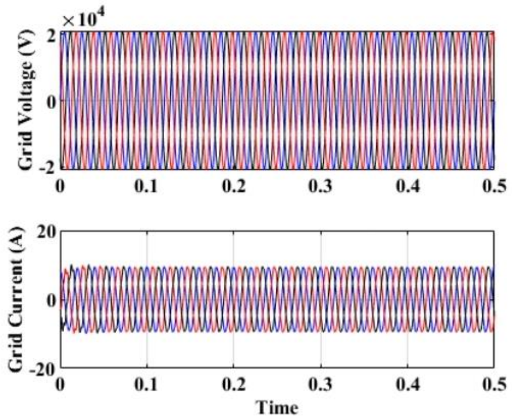


. Load Demand, Solar Power, Grid Power and BatteryPower in Case 5



Three phase Load Voltage and Current at load sidein case 5.



Case 6: Linear Un-Balance Load Variation withExtended Search Algorithm Power Factors for Inverter Load Current of case 6[4].

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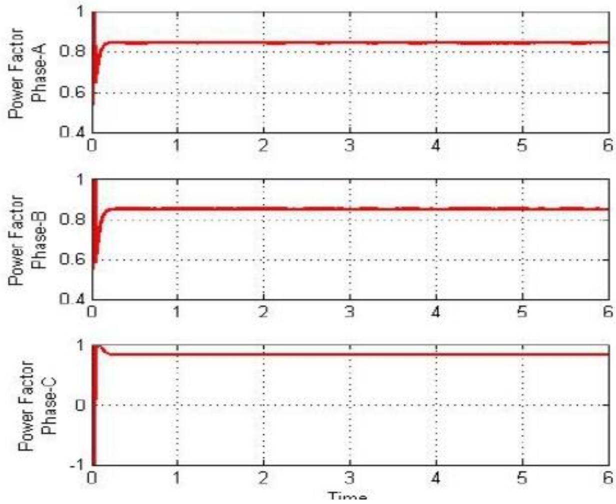
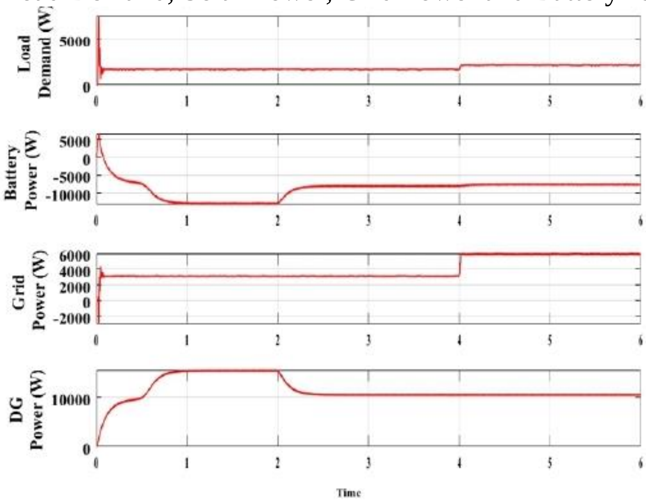
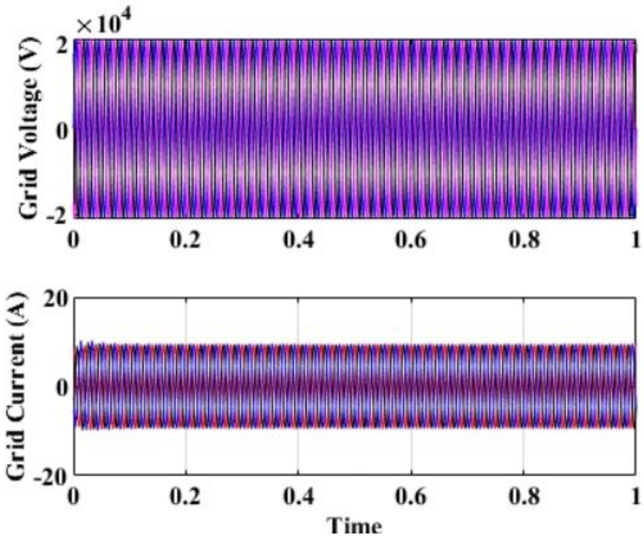


. Load Demand, Solar Power, Grid Power and BatteryPower in Case 6[5].



Simulation result for Load Voltage and Current ofCase 6



Case 7: Non-Linear Load Variation with ExtendedSearch Algorithm

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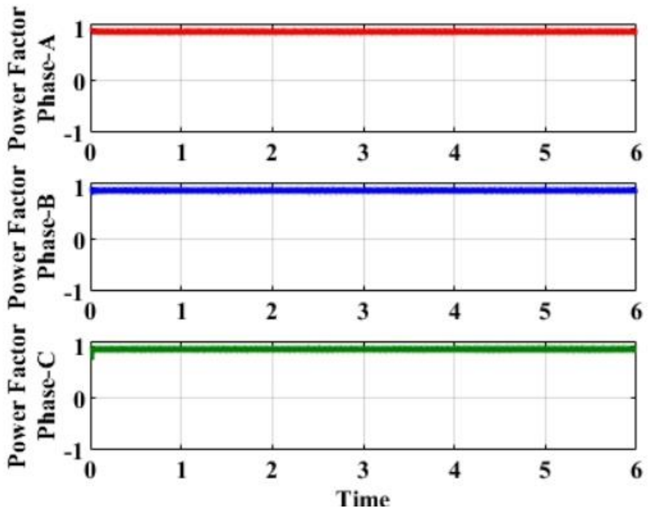
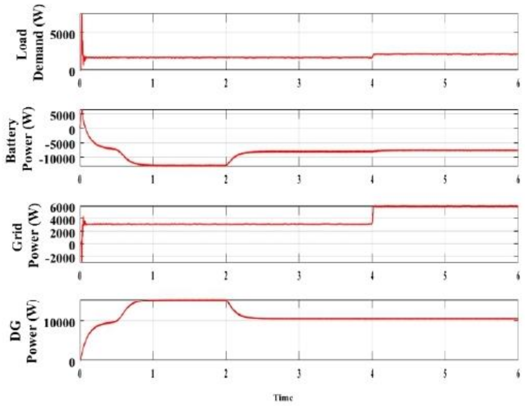
POWER FACTORS FOR INVERTER LOAD CURRENT OF CASE 7



Load Demand, Solar Power, Grid Power and Battery Power in Case



CONCLUSION

AN ES ALGORITHM IS SUGGESTED AS A DISTRIBUTED POWER SYSTEM CONTROLLER TO ENHANCE THE QUALITY OF POWER IN A GRID-CONNECTED HYBRID SYSTEM WITH BATTERY STORAGE WITHOUT IMPAIRING ITS REGULAR ACTUAL POWER TRANSFER OPERATION. THE ESA IS USED TO CONSTRUCT THE IDEAL SET OF PARAMETERS, AND THE PI APPROACH IS USED TO FORECAST THE IDEAL CONTROL SIGNALS. SIMILAR TO THIS, THE CURRENT IMBALANCE, CURRENT HARMONICS, AND LOAD REACTIVE POWER CAUSED BY AN UNBALANCED NON-LINEAR LOAD CONNECTED TO THE PCC ARE SUCCESSFULLY CORRECTED SO THAT THE GRID SIDE CURRENT IS BALANCED SINUSOIDAL AT UNITY POWER FACTOR. THEN, USING THE MATLAB/SIMULINK WORKING PLATFORM,

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THE SIMULATION RESULTS OF THE SUGGESTED METHOD ARE VERIFIED.

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