

Reactive Power Compensation by using V2G Technology

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Abstract

This paper presents however the vehicle to grid (V2G) technology is incredibly useful for compensating the reactive power and to boost the ability issue. The bi-directional charger are able to do three functions, together with battery charging, grid-connection and reactive power compensation, that square measure keys for management of the grid and it'll profit for each grid and electricity shopper. The planned system consists of fuzzy logic controller (FLC), it gives a robust performance under parameter variation, load variation and it can cover wide range of operating conditions and helps to boost the system performance. The comparison of the improved simulation and experimental results concludes the fortunate implementation of controller.

Key Words:Hydrogel; bioink; cartilage; artificial knee replacement; Biodegradable;

1 INTRODUCTION

Due to the more and more outstanding energy downside and environmental pollution, electrical vehicles (EVs) area unit bit by bit replacement ancient cars equipped with combustion engines[1], the continual development of outstanding performance batteries and high-efficiency motors conjointly has spurred dramatic interest in EVs, that area unit considered representatives of latest energy vehicles The EVs area unit like insert hybrid electrical vehicles (PHEV), electrical cars (BEV), electric cell electrical vehicles (FCEV), communicate with the facility grid to sell demand response services by either returning electricity to the grid or by asphyxiation their charge rate. It represents a basic V2G framework that consists of general grid parts renewable energies, hundreds and a few different good systems [8,9]. consistent with the V2G idea, EVs aren't solely ancient power shoppers, however conjointly mobile distributed generators returning the additional power to the grid once they area unit idle, which might improve energy management of the grid [1012]. On the opposite hand, it's usually identified that the reactive compensation plays a crucial role in rising the facility quality associate degreeed providing the grid with an economical in operation mode [13]. Realizing the native compensation of reactive power with less investment and faster result is very important to the facility system. By compensating the reactive power the facility issues are often improved. Considering the large scale applications of EVs and the benefits of V2G system, like quick response and no extra price, EVs area unit the promising devices for reactive power native compensation. In the control technique, fuzzy controller is implemented. Fuzzy control rule can be considered as the knowledge of an expert in any related field of application. The fuzzy rule is represented by a sequence of the form IF-THEN. A fuzzy IF-THEN rule associates a condition described using linguistic variables and fuzzy sets to an output or a conclusion. The IF part is mainly used to capture knowledge by using the elastic conditions, and the THEN part can be utilized to give the conclusion or output in linguistic variable for vehicle to grid technology permits bidirectional power flow between the battery of electrical vehicle and also the grid. This enables "peak load shaving, load leveling, voltage regulation and enhancements of installation stability". small grid are gener-

ally used for energy storage system like renewable energy sources like star, wind, hydro, cogeneration technique in industrial space and one of the vehicle to grid applications[4]. The requirement of small grid for the applications is to scale back transmission losses and offer to produce prime quality and reliable energy supply to crucial load.

2 CONCEPT OF V2G

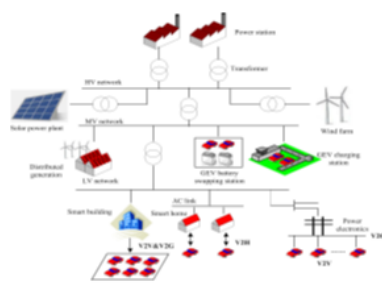
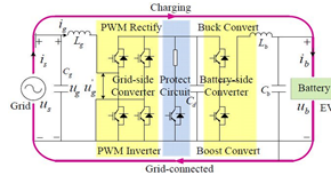


Fig 2.1framework of v2g

3 EXISTING SYSTEM

In the existing system, for the conversion technique bidirectional cuk convertor is employed. So as to step down the voltage and accelerate the voltage, it's terribly like the operation of buck-boost convertor, offers inverting output voltage with regard to the input voltage. The advantages of CUK convertor square measure "continuous input and output current". Energy is transferred once the switch is open and closed. Since the CUK convertor uses LC filter the "peak-peak ripple current of inductance square measure less". Main supply of energy during this project is automobile battery and it's enforced once the cars square measure idle within the car park. PR controller is enforced during this system.

4 BASIC BLOCK DIAGRAM OF V2G:



The planned bi-directional transfer circuit topology for V2G is advocate which has a grid-side convertor, a protection circuit and a battery-side convertor. Meanwhile, this V2G system will operate in 3 modes: charging mode, grid-connected mode and reactive power compensation mode. in several in operation modes, notwithstanding it's constant a part of this planned circuit, the circuit parts can play a unique role. In "charging mode", the grid-side convertor could be a "PWM rectifier" and also the battery-side convertor could be a "buck converter". In "grid-connected mode", the grid-side convertor could be a "PWM inverter" and also the battery-side convertor is a "boost converter". In "reactive power compensation mode", the grid-side convertor could be a "reactive power compensator" and also the battery-side convertor is a "boost converter". The protection circuit is meant to produce a discharging channel, which may consume surplus energy on the circuit and so limit the voltage worth of the DC-link.

5 PROPOSED SYSTEM:

5.1 FUZZY LOGIC CONTROLLER:

Fuzzy controllers are used to control consumer products, such as washing machines, video cameras, and rice cookers, as well as industrial processes, such as cement kilns, underground trains, and robots. Fuzzy control is a control method based on fuzzy logic. Just as fuzzy logic can be described simply as computing with words rather than numbers, fuzzy control can be described simply as control with sentences rather than equations. A fuzzy controller can include empirical rules, and that is especially useful in operator controlled plants.

Take for instance a typical fuzzy controller

1. If error is Neg and change in error is Neg then output is NB
2. If error is Neg and change in error is Zero then output is NM

The collection of rules is called a Rule base

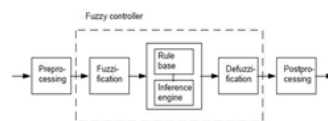


Figure 4: Blocks of a fuzzy controller.

Preprocessing: The inputs are most frequently laborious or crisp measurements from some activity instrumentation, instead of linguistic. A pre-processor conditions the measurements before they enter the controller. Samples of preprocessing are:

- quantization in reference to sampling or rounding to integers;
- standardisation or scaling onto a specific, normal range;
- filtering so as to get rid of noise;
- averaging to get future or short term tendencies;
- a mixture of many measurements to get key indicators; and
- differentiation and integration or their distinct equivalences.

Fuzzification: The first block within the controller is fuzzification, that converts each bit of input information to degrees of membership by a operation in one or many membership functions. The fuzzification block so matches the computer file with the conditions of the principles to work out however well the condition of every rule matches that specific input instance. there's a degree of membership for every linguistic term that applies to it input variable.

Rule base: The rules might use many variables each within the condition and also the conclusion of the principles. The controllers will thus be applied to each multi-input-multi-output (MIMO) issues and single-input-single-output (SISO) issues In several systems, the principles square measure given to the end-user during a format almost like the one below,

1. If error is Neg and change in error is Neg then output is NB
2. If error is Neg and change in error is Zero then output is NM
3. If error is Neg and change in error is Pos then output is Zero
4. If error is Zero and change in error is Neg then output is NM
5. If error is Zero and change in error is Zero then output is Zero
6. If error is Zero and change in error is Pos then output is PM
7. If error is Pos and change in error is Neg then output is Zero
8. If error is Pos and change in error is Zero then output is PM
9. If error is Pos and change in error is Pos then output is PB

The names Zero, Pos, Neg are labels of fuzzy sets as well as NB, NM, PB, PM (negative big, negative medium, positive big, and positive medium respectively).

		Change in error		
		Neg	Zero	Pos
Error	Neg	NB	NM	Zero
	Zero	NM	Zero	PM
	Pos	Zero	PM	PB

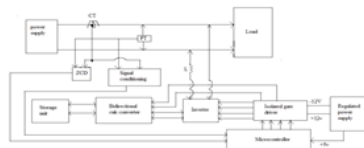
Error	Change in error	Output
Neg	Pos	Zero
Neg	Zero	NM
Neg	Neg	NB
Zero	Pos	PM
Zero	Zero	Zero
Zero	Neg	NM
Pos	Pos	PB
Pos	Zero	PM
Pos	Neg	Zero

Inference Signal Process: one need combine the Membership Functions with the control rules to derive the control output, and arrange those outputs into a table called the lookup table. The control rule is the core of the fuzzy inference process, and those rules are directly related to a human beings intuition and feeling.

Defuzzification: The resulting fuzzy set must be converted to a number that can be sent to the process as a control signal. This operation is called defuzzification. Three defuzzification techniques are commonly used, which are: Mean of Maximum method, Center of Gravity method and the Height method.

Post processing: Output scaling is additionally relevant. just in case the output is outlined on a customary universe this should be scaled to engineering units, as an example, volts, meters, or tons per hour. Associate degree example is the scaling from the quality universe $[-1,1]$ to the physical units $[-10,10]$ volts. The post processing block usually contains associate degree output gain that may be tuned, and generally also associate degree plan meter. Membership function: membership functions can have multiple different types, such as the triangular waveform, trapezoidal waveform, Gaussian waveform, bell-shaped waveform, sigmoidal waveform and S-curve waveform. The exact type depends on the actual applications. For those systems that need significant dynamic variation in a short period of time, a triangular or trapezoidal waveform should be utilized. For those system that need very high control accuracy, a Gaussian or S-curve waveform should be selected.

6 BLOCK DIAGRAM:



6.1 DESCRIPTION:

The power generated at the facility system is in potential unit and its step down in many stages before distributed among the patron. after we think about the instance of malls and industries if the load is linear, the condition are in resonance and that we can get the output what was provided as Associate in Nursing input, else if the load is non-linear, then the resonance condition won't occur. so as to achieve the resonance condition the reactive power compensation is crucial. Here this and potential transformers area unit wont to sense the high current and voltage at the generating station. Then the detected current and voltage parameters area unit fed into the zero cross detector that detects wherever this and voltage area unit in in-phase aren't. at the same time the signal learning converts the analog signal into digital signals that is suitable by

the microcontroller. the utmost input to the microcontroller is 5v therefore the signal learning converts the analog signal to digital equals to the number of analog signal. The regulated power offer is provided to provide power to microcontroller and isolated gate driver.

The microcontroller provides the comfortable signal for the attainment of resonance condition to the isolated gate driver and duplex CUK device, in order that switches area unit triggered. The motive force may be power electronic equipment that accepts the low power input and produces the high current drive input for the gate of MOSFET. The MOSFET gate drive on to coupling series provides quick switch specifications permitting designers to use smaller filters, thereby reducing overall system power consumption. therefore the MOSFET produces the high current which are given to the battery from that voltage is extracted which are given to the CUK device to spice up it. Once the voltage is boosted then it's forwarded to the electrical converter, for changing the voltage into AC signal then fed to the micro-grid wherever the reactive power compensation is achieved. Power is extracted from grid once most power flow is detected. The AC offer is reborn into DC and it's stepped down exploitation CUK device then keeps within the battery.

7 CONTROL SCHEME

7.1 GRID SIDE CONVERTER

The improved V-I double-loop management theme is used within the grid-side device management .In different operational modes; management strategy of grid electrical converter can vary. In" charging mode", grid current is controlled by a" fuzzy controller" to prevent steady state errors. A "voltage feed forward" is employed to boost the dynamic performance, that reduces the following errors of system. PWM signals with fuzzy controller is introduced to regulate the device .In "grid connected mode", to attain zero steady state errors, fuzzy has additional benefits once in steady frame than PR controller with infinite gain at resonant frequency and desirable following capability.

7.2 CONTROL SCHEME FOR REACTIVE POWER COMPENSATION

A simplified model for the household single-phase power supply system is shown in Figure 2, where the power grid is considered to be infinite and all the loads and EVs are the terminal loads.

$$i_s = i_g + i_l \text{ and}$$

$$u_s = u_g = u_l$$

Where u_s and i_s are the grid side voltage and grid side current respectively. u_l and i_l are the load-side voltage and load side current and u_g and i_g are the voltage and current of grid-side converter

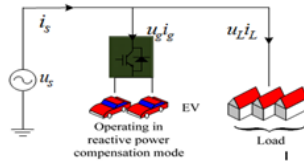


FIG. 2. SIMPLIFIED MODEL OF HOUSEHOLD SINGLE PHASE POWER SUPPLY SYSTEM

According to the characteristics of the proposed V2G topology, in "reactive power Compensation mode", the battery-side converter is a boost converter and the grid-side converter is a reactive power compensator. With the resistance-inductor load, the equivalent circuit and its phase diagram are shown in Fig.3 with the resistance-inductor load; the equivalent circuit and its phase diagram are shown in Fig.7.3

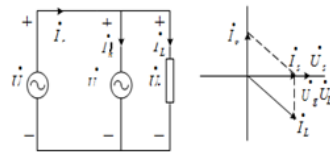


FIG.7 Equivalent Circuit and Vector Diagram for EV System Connected To Inductive Load

8 COMPARSION OF EXSISTING OF EXISTING PR CONTROLLER AND PROPOSED FUZZY CONTROLLER

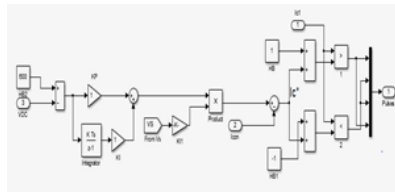


Fig.8.1 PR CONTROLLER

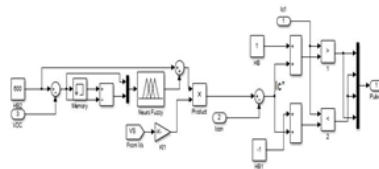


Fig.8.2 FUZZY CONTROLLER

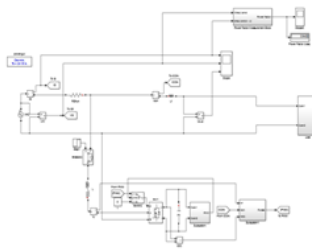


Fig.8.3.FINAL SIMULATION DIAGRAM

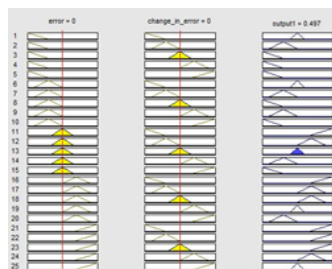


Fig.8.4 FUZZY RULES

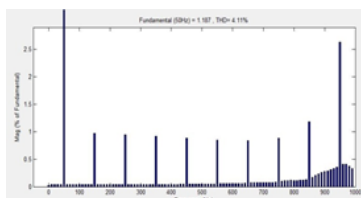


Fig.8.5 THD RESULT OF FUZZY CONTROLLER



Fig.8.5 REACTIVE POWER COMPENSATION



FIG.8.6 FINAL OUTPUT WAVEFORM

9 CONCLUSION

This project offers a replacement conversion for vehicle-to-grid (V2G), as well as bi-directional convert topology, management strategy and reactive compensation application supported V2G. Moreover, the management theme of V2G for reactive power compensation is analyzed. An impact theme combined with fast reactive power detection strategies. The simulation and experimental results show that the fuzzy logic controller (FLC) will perform well in reactive power compensation on the grid side network and in the power factor improvement.

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