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A Dual Buck-Boost Ac Dc Converter for Grounding in the Dc Nano Grid

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ABSTRACT

Because of the generally utilized DC portrayed loads and progressively distributed power generation sources, the DC Nano-grid turns out to be increasingly well known and it is viewed as an option in contrast to the AC-grid. For security contemplations, the DC Nano-grid should give solid establishing to the private loads like the low voltage AC power system. There are three regular establishing setups for a DC Nano-grid, including the assembled establishing, the unidirectional establishing and the virtual confined establishing. Each establishing arrangement has its very own details to AC/DC converters. In this venture, a double Buck-Boost AC/DC converter for use in the unified establishing setup based DC Nano-grid with three terminal yields is proposed. The working rule of this converter is introduced in subtleties through breaking down the proportional circuits.

INTRODUCTION:

The distributed power generation is winding up increasingly more appealing because of the long haul absence of vitality and the ecological issues brought about by the fossil vitality. An enormous number of distributed generation systems, as photovoltaic systems, are today associated into the AC power system, where they can cause issues like voltage rise and furthermore issue identified with insurance. Further, an ever increasing number of loads show DC attributes, for instance, LED lightings, PC power supplies and furthermore factor recurrence methods based family electrical apparatuses.

The DC Nano-grid might be a decent answer for fathom the voltage rise and assurance issue of the regular AC power system and can reject the customary AC/DC converters for DC described loads, which may result in diminished power misfortunes and material funds.

As of late, look into on DC Nano-grid gets of increasingly more concern, particularly for the control of AC/DC topologies which are the associations between the DC Nano-grid and the conventional AC power system. It ought to be called attention to, when structuring the AC/DC converters for DC Nano-grids, the establishing configuration should be tended to, since it decides the costs, the adaptability of the establishment and furthermore the productivity of DC Nano-grid system.

This letter investigates initial three establishing configurations of the DC Nano-grid. At that point, a dual Buck-Boost AC/DC converter is proposed, which will encourage the uses of the DC Nano-grid with three terminal outputs. Additionally, hypothetical examination of the proposed converter will be given just as trial checks are completed. At last, ends are drawn.

1.2. DC NANO GRID:

A nanogrid is a hybrid system which includes a blend of inexhaustible and non-sustainable generation. Power hardware is the empowering innovation of this system, being utilized to associate the

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two sources and loads to the transmission arrange. This part exhibits the nanogrid idea in more detail, starting with a portrayal of the structure of the system.

Specialty applications for the system are featured on the grounds that in the flow power advertise, little sustainable based systems are not cost-aggressive with the traditional air conditioning system. The attributes of the sources and loads present in the nanogrid are likewise clarified since this effect the decision of working recurrence and control topology.

1.2.1.NANOGRID STRUCTURE:

The structure of a Nano grid is appeared in Figure 1.1. The essential structure squares of a Nano grid are power electronic interface converters. Venture up converters permit low voltage sources to supply power to the nanogrid, and venture down converters enable the loads to draw power from the nanogrid. Bidirectional converters enable capacity hubs to charge from and release in to the nanogrid.

A side from the interface converters, a nano grid involves sustainable sources, stockpiling, and non-inexhaustible back up generation, loads, and a transmission arrange. Variable sustainable sources supply the normal burden request, and since the pinnacle output of these sources is unequipped for being controlled, vitality stockpiling gadgets are incorporated into the system to go about as a vitality support, adjusting contrasts between the source and burden powers. Reinforcement generation possibly included to improve the system's dependability in case of a long haul short period of sustainable power source.

Being a distributed system, a nanogrid has the benefits of expanded repetition and simplicity of extension contrasted with a concentrated power system. Generator disappointment in a cen-tralised power system majorly affects the system; in any case, in a distributed system, the system isn't totally disabled by supply disappointment as extra supply hubs are as yet working.

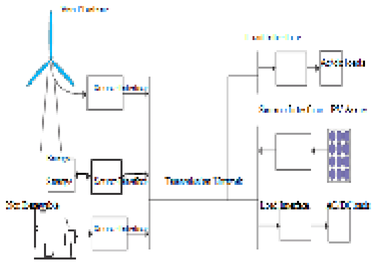

Figure 1.1.Structure of a standalone hybrid renewable nanogrid

The distributed structure of the nanogrid likewise loans itself well to particular on struction and simple development. The requirement for beginning venture is in this way decreased since the system can be made little at first and afterward extended as the heap request develops. While there is no physical limitation on the extent of a nanogrid in principle, productivity and financial aspects will to a great extent direct the measure of a nanogrid by and by. For instance, expanding the extent of a nanogrid by including inaccessible loads may improve the suitability of the nanogrid because of the economies of scale that are picked up in utilizing enormous regenerators.

Other variable factors, for example, government appropriations, mechanical advances, and large scale manufacturing will likewise influence the monetary achievability and thus size of a nanogrid. For the motivations behind this postulation notwithstanding, the span of a nanogrid that is considered is a bunch of

2-10 neighborhood loads that are situated inside 5 km of the sources. Expecting these loads are private sort loads, the power rating of such a system would be around 2-20kW. High voltage transmission isn't required for a system of this scale. Transmission voltages of a few hundred volts are adequate to give proficient transmission of electrical vitality in a restricted system with these determinations. This will be illustrate

NANO GRID NICHE

Regulatory changes to the electricity industry and environmental concerns over burning fossil fuels to generate electricity have height ended the interest in renewable energy systems. However, renewable-based nanogrids are restricted to niche applications for economic reasons. In the current market environment, the cost of electricity from small renewable sources tends to be more expensive than the cost of electricity from the ac network.

Only form of renewable generation that is cost competitive with conventional forms of generation is large-scale wind power generation, For this reason, the primary niche for nano grids is currently found in applications such as remote are power supplies, where the cost of connecting to the conventional ac system is prohibitive.

In both industrialised and developing countries, it is generally uneconomic to connect remote loads to the existing electricity grid. The viability of using a nanogrid to supply electricity to local loads improves in these remote applications since the cost of connecting to the existing system outweighs the higher generation cost of the small-scale renewable sources present in the nanogrid.

Nanogrids may also be available option for rural electrification programs in developing countries. Using a multitude of small renewable based systems to supply widely dispersed villages decreases transmission line losses, and allows the system to be built with little initial capital investment. With a central power system, a large amount of capital is required to build the power station before the electrification process can commence.

In the future, nanogrids may find application in rural locations already serviced by an electricity network. The continuance of supply clause in New Zealand's Electricity Act states that on 31 March 2013, distribution companies will be released from the obligation to supply existing customers. The implication of this act is that customers in rural loca- tions will begin to pay the true cost for their line-delivered electricity, which is currently subsidised. Forming a renewable-based system such as a nanogrid maybe come viable, especially if the system supplies a cluster of loads.

Forming a single hybrid power system to supply multiple customers in a local cluster is likely to be more economic than building a power system for each individual customer. The cost of electricity supplied by a hybrid system to a single house is significantly more expensive than the current cost of grid electricity.

However, it has been shown that ag- aggregating number of loads improves the viability of standalone hybrid systems. For example, the cost of supplying a cluster of twenty houses using a wind turbine and diesel generator is competitive with the existing cost of supply. This is due to an improvement in load factor and economies of scale present when purchasing generation.

Another future niche application for nanogrids, also to be found in rural locations, is parts of New Zealand's rural power system serviced by single wire earth return (SWER) systems. SWER systems are characterised by long feeders and high resistance lines. Consequently, the lines are limited by the voltage deviation at the receiving end of the line rather than the current rating of the wires.

Some of these systems are facing the need for an imminent upgrade since the system is operating at the limit of the accept able voltage envelope. In addition, some of these feeders are nearing the end of their operational life. By deferring an upgrade, significant cost savings can be made. One means of deferring the upgrade is to install systems such as nanogrids to reduce the loading on the lines, or to help support the voltage at the end of the line.It should also be mentioned that installing a nanogrid in rural locations may also benefit the end user. Customers in rural locations typically experience significant voltage deviations and frequent power outages. Forming a local system will improve the supply quality and increase the reliability of supply.

Over the next ten years, New Zealand's power system will continue to change, making it more viable for renewable energy systems to enter main stream applications. The price of electrical energy will continue to increase due to increasing load demands, decreasing natural gas reserves and diminishing generation reserves.

Carbon taxes under the Kyoto protocol and the continuance of supply clause affecting distribution companies may ac- celebrate the price increase. At the same time, the cost of renewable energy systems will continue to decrease due to technological advances and mass production. As the price of conventional and renewable generation changes, the breakeven point will also shift, facilitating the movement of nanogrids from niche to mainstream applications.

SIMULATION AND RESULT

7.1. INTRODUCTION:

Mat lab is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include Math and computation Algorithm development Data acquisition Modeling, simulation, and prototyping Data analysis, exploration, and visualization Scientific and engineering graphics Application development, including graphical user interface building.

Mat lab is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar no interactive language such as C or FORTRAN.

The name Matlab stands for matrix laboratory. Mat lab was originally written to provide easy access to matrix software developed by the LINPAC and eispack projects. Today, mat lab engines incorporate the lapack and blas libraries, embedding the state of the art in software for matrix computation.

Mat lab has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, mat lab is the tool of choice for high-productivity research, development, and analysis.

Mat lab features a family of add-on application-specific solutions called toolboxes. Very important to most users of mat lab, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of mat lab functions (M-files) that extend the mat lab environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others. The Matlab system consists of following main parts:

7.1.Development Environment:

This is the set of tools and facilities that help you use matlab functions and files. Many of these tools are graphical user interfaces. It includes the matlab desktop and Command Window, a command history, an editor and debugger, and browsers for viewing help, the workspace, files, and the search path.

The mat lab Mathematical Function Library:

This is a vast collection of computational algorithms ranging from elementary functions, like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

The mat lab Language:

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create large and complex application programs.

Mat lab has extensive facilities for displaying vectors and matrices as graphs, as well as annotating and printing these graphs. It includes high-level functions for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level functions that allow you to fully customize the appearance of graphics as well as to build complete graphical user interfaces on your mat lab applications.

The matlab Application Program Interface (API):

This is a library that allows you to write C and FORTRAN programs that interact with mat lab. It includes facilities for calling routines from mat lab (dynamic linking), calling mat lab as a computational engine, and for reading and writing MAT-files.

7.2. SIMULINK:

7.2.1.Introduction:

Simulink is a software add-on to matlab which is a mathematical tool developed by The Math works,(http://www.mathworks.com) a company based in Natick. Matlab is powered by extensive numerical analysis capability. Simulink is a tool used to visually program a dynamic system (those governed by Differential equations) and look at results. Any logic circuit, or control system for a dynamic system can be built by using standard building blocks available in Simulink Libraries. Various toolboxes for different techniques, such as Fuzzy Logic, Neural Networks, dsp, Statistics etc. are available with Simulink, which enhance the processing power of the tool. The main advantage is the availability of templates / building blocks, which avoid the necessity of typing code for small mathematical processes.

Concept of signal and logic flow:

In Simulink, data/information from various blocks are sent to another block by lines connecting the relevant blocks. Signals can be generated and fed into blocks dynamic / static).Data can be fed into functions. Data can then be dumped into sinks, which could be scopes, displays or could be saved to a file Thus, a simulation time step (otherwise called an integration time step) is essential, and the selection of that step is determined by the fastest dynamics in the simulated system.

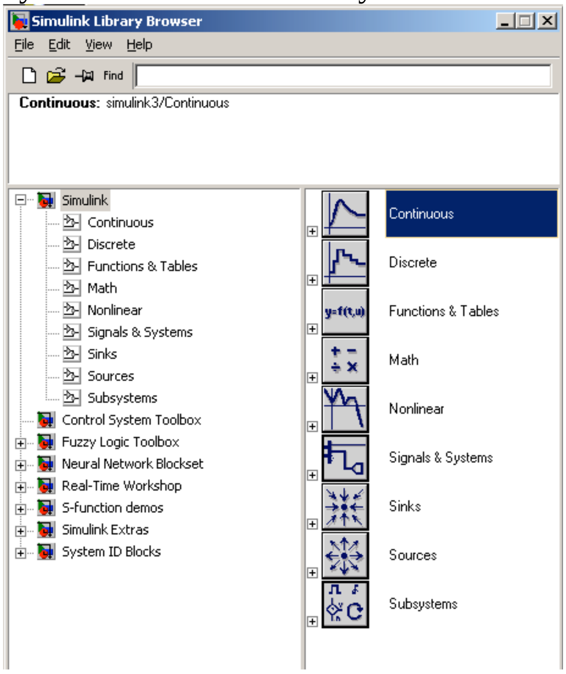

Fig 7.1. Simulink library browser

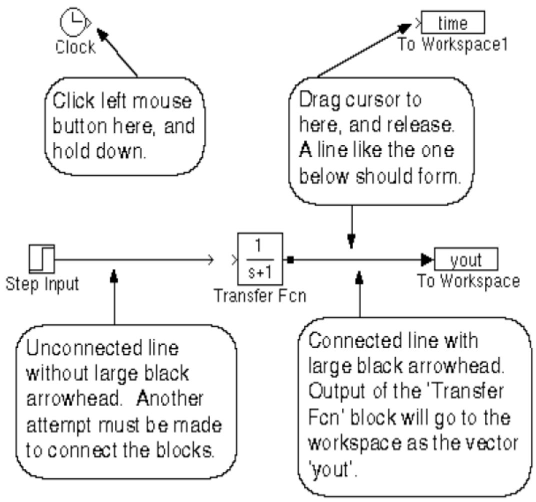

fig 7.2. Connectung blocks

To connect blocks, left-click and drag the mouse from the output of one block to the input
of another block.

7.2.3. Sources and sinks:

The sources library contains the sources of data/signals that one would use in a dynamic system simulation. One may want to use a constant input, a sinusoidal wave, a step, a repeating sequence such as a pulse train, a ramp etc. One may want to test disturbance effects, and can use the random signal generator to simulate noise. The clock may be used to create a time index for plotting purposes. The ground could be used to connect to any unused port, to avoid warning messages indicating unconnected ports.

The sinks are blocks where signals are terminated or ultimately used. In most cases, we would want to store the resulting data in a file, or a matrix of variables. The data could be displayed or even stored to a file. the stop block could be used to stop the simulation if the input to that block (the signal being sunk) is non-zero. Figure 5.3 shows the available blocks in the sources and sinks libraries. Unused signals must be terminated, to prevent warnings about unconnected signals.

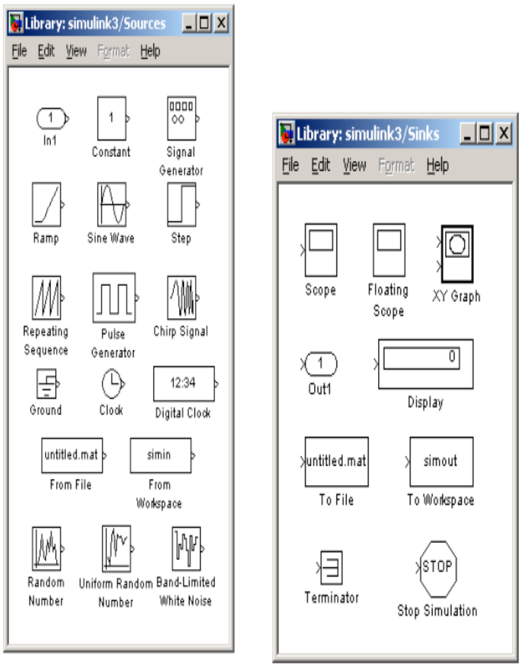

Fig7.3. Sources and sinks

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7.3. CONTINUEOS AND DISRETE SYSTEMS:

All dynamic systems can be analyzed as continuous or discrete time systems. Simulink allows you to represent these systems using transfer functions, integration blocks, delay blocks etc.

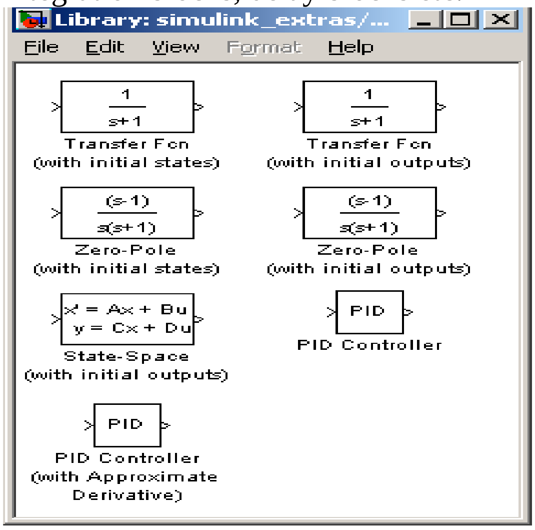

fig 7.4. continueos and descrete systems

7.3.1. Non-linear operators:

A main advantage of using tools such as Simulink is the ability to simulate non-linear systems and arrive at results without having to solve analytically. It is very difficult to arrive at an analytical solution for a system having nonlinearities such as saturation, signup function, limited slew rates etc. In Simulation,

Since systems are analyzed using iterations, nonlinearities are not a hindrance. One such could be a saturation block, to indicate a physical limitation on a parameter, such as a voltage signal to a motor etc. Manual switches are useful when trying simulations with different cases. Switches are the logical equivalent of if-then statements in programming.

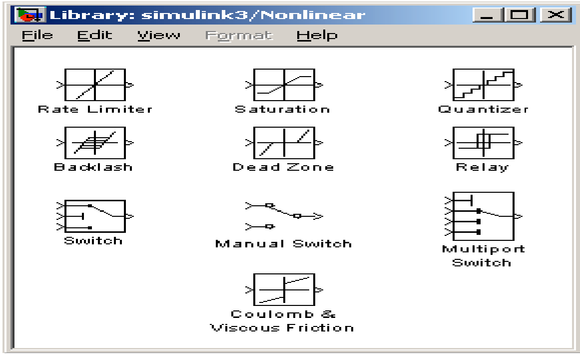

fig 7.5. simulink blocks

7.3.2. Mathematical operations:

Mathematical operators such as products, sum, logical operations such as and, or, etc. can be programmed along with the signal flow. Matrix multiplication becomes easy with the matrix gain block. Trigonometric functions such as sin or tan inverse (at an) are also available. Relational operators such as ‘equal to’, ‘greater than’ etc. can also be used in logic circuits

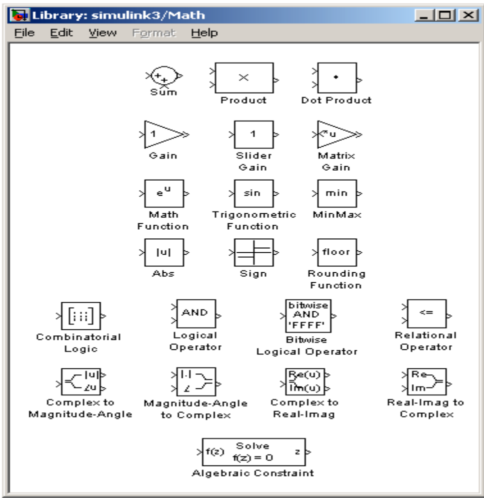

fig 7.6. Simulink math blocks

SIGNALS & DATA TRANSFER:

In complicated block diagrams, there may arise the need to transfer data from one portion to another portion of the block. They may be in different subsystems. That signal could be dumped into a go to block, which is used to send signals from one subsystem to another.

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Multiplexing helps us remove clutter due to excessive connectors, and makes matrix (column/row) visualization easier.

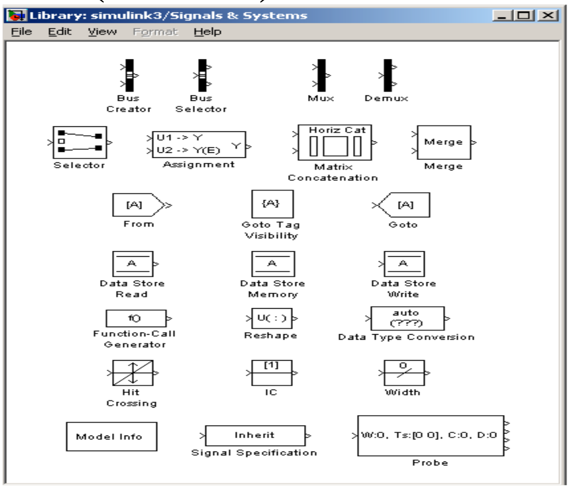

fig 7.7. signals and systems

7.5. MAKING SUBSYSTEM:

Drag a subsystem from the Simulink Library Browser and place it in the parent block where you would like to hide the code. The type of subsystem depends on the purpose of the block. In general one will use the standard subsystem but other subsystems can be chosen. For instance, the subsystem can be a triggered block, which is enabled only when a trigger signal is received.

Open (double click) the subsystem and create input / output PORTS, The input and output ports are created by dragging them from the Sources and Sinks directories respectively. When ports are created in the subsystem, they automatically create ports on the external (parent) block. This allows for connecting the appropriate signals from the parent block to the subsystem.

7.5.1 Simulation parameters:

Running a simulation in the computer always requires a numerical technique to solve a differential equation. The system can be simulated as a continuous system or a discrete system based on the blocks inside. A Fixed step size is recommended and it allows for indexing time to a precise number of points, thus controlling the size of the data vector. Simulation step size must be decided based on the dynamics of the system. A thermal process may warrant a step size of a few seconds, but a DC motor in the system may be quite fast and may require a step size of a few milliseconds.

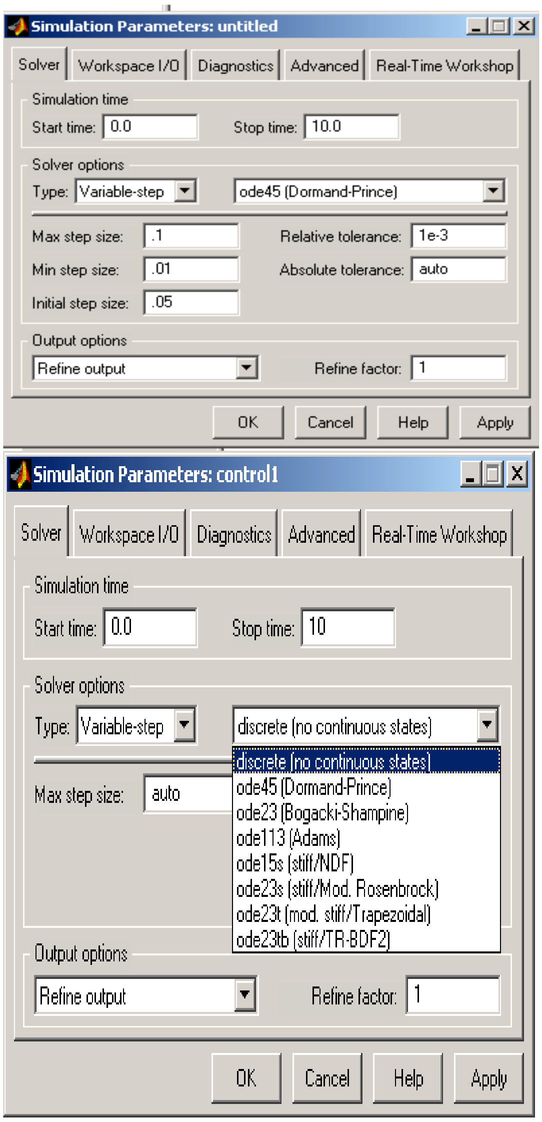

fig 7.8. Simulation Parameters

COMPUTER SIMULATIONS AND EXPERIMENTAL RESULTS:

Experiments on the proposed AC/DC converter are carried out under the AC grid condition of 110 V/ 50 Hz. The parameters of the prototype are listed in Table I.

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TABLE I
DESIGN PARAMETERS OF A 1 KW AC/DC CONVERTER

Para.	L_g	C	L_P, L_N	f_s	E_1, E_2
Units	200 µH	2 µF	400 µH	60 kHz	90V

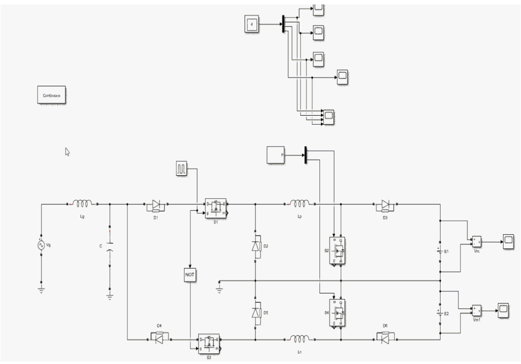

Fig.7.9.1.Circuit Diagram of AC/DC converter

An input ac voltage source with 100 v is taken with inductance of 200 uH and parallel capacitor of 2 uF is taken. Four Mosfets have been arranged in full bridge format. Inductors of Lp and Ln with value of 400 uH is connected. Two DC voltage sources of 90 V each, connected in back to back.

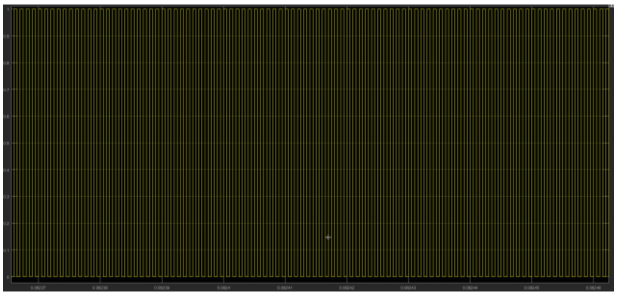

Fig.9.2.Pulses for S1 and S3

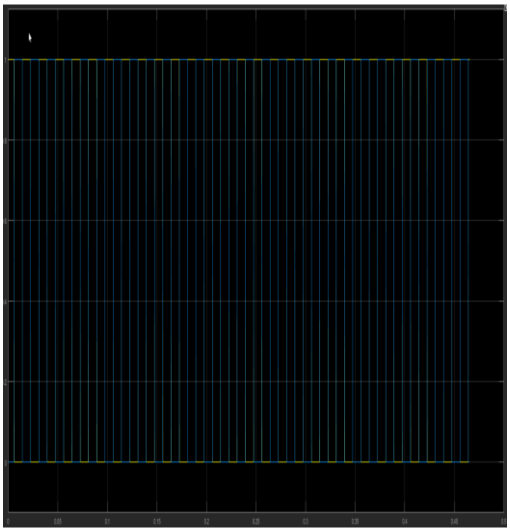

Fig7.9.3.Pulse for S2 and S4

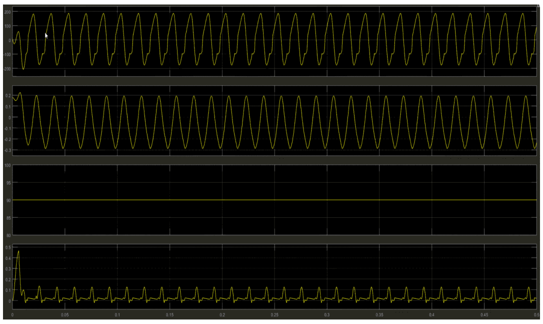

Fig.7.9.4.Output Waveform

Output figure shows the input AC grid voltage Vg, output positive DC voltage E1, the input AC grid current iLg, and the inductor current of LN. The experimental results meet the theoretical analysis well.

CONCLUSIONS

In private applications, the DC Nano-grid ought to give ground line to security. The establishing configuration decides the various necessities on the AC/DC converters.

In this Project, three sorts of the establishing configurations for the DC Nano-grid are abridged. It very well may be finished up The unified establishing configuration is the most appealing since the DC Nano-grid can be legitimately associated with the low AC power system utilizing a similar ground line, which will unequivocally address the high proficiency character of the DC Nanogrid. This establishing configuration makes it simple to develop a DC Nano-grid dependent on the first low voltage AC power system and adds to the use of the DC Nano-grid. Be that as it may, appropriate AC/DC converters are right now missing of this establishing configuration.

The uni directional establishing configuration is generally presented in current DC Nano-grids. It is reasonable for development another DC Nano-grid alone.

Contrasted and the assembled and unidirectional establishing configurations, the adaptability of the virtual secluded establishing configuration is great, however it results in decreased productivity, more materials and there by greater expenses. In light of the examination on the establishing, a dual Buck-Boost AC/DC converter is proposed for the unified establishing configuration based DC Nano-grid. The standard of the proposed converter is outlined utilizing proportional circuits. Investigations are in great concurrence with the hypothetical examination. The proposed AC/DC converter will misuse the utilization of the DC Nano-grid with three terminal outputs.

Test VERIFICATION:

Tests on the proposed AC/DC converter are completed under the AC grid state of 110 V/50 Hz. The parameters of the model are recorded in Table I.

TABLE I

DESIGN PARAMETERS OF A 1 KW AC/DC CONVERTER

Para.	L_g	C	L_P, L_N	f_s	E_1, E_2
Units	200 μH	2 μF	400 μH	60 kHz	90V

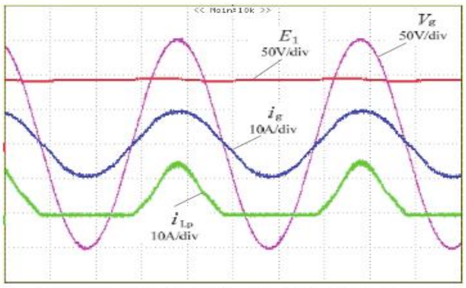

Fig. 8. Measured output DC positive voltage E_1, input AC voltage V_g, inductor current of L_P, and input grid current of i_g.

Fig.10. shows the input AC grid voltage Vg, output positive DC voltage E1, the input AC grid current i g, and the inductor current of LN. The experimental results meet the theoretical analysis well.

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