ISSN(Online):2320-9801
ISSN(Print): 2320- 9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Special Issue 3, July 2014

Optimal Operation of Power in Renewable Energy by Using prediction in Recurrent Neural Network

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ABSTRACT*:* large demand for electricity due to rapid increasing of population growth, using power generation systems renewable energies have widely been studied, and introduction of the power generation systems into many fields such as houses or buildings is accelerating. The optimal control method using prediction technique of recurrent neural networks for a wind solar power energy generationsystem is to be sort out in this paper . In the conventional control method, the optimization problems for the wind solar energy power generation systems are regarded as the linear programming problems and theysolved the problems by the recurrent neural networks. Then, results indicate that the control method has much possibility to apply into the real power generation systems. From the results of the numerical simulations, the control method with the recurrent neural networks prediction technique exhibits good performance even if more realisticconditions are introduced.

KEYWORDS: Prediction; RNN; Wind Solar energy; NN control method

I. INTRODUCTION

To build an eco-safety society we need to
replace the conventional energy systems such as fossil fuelenergy plants or nuclear power plants by introducing the power generation system by renewable energy such as a photovoltaic power generation system or a wind power generation system. Thus, we need to introduce a sophisticatedcontrolling method to use the power generation systems.However,the power generation system using by the renewable energy has undesirable problems to implement into the power supply systems

II. SYSTEM MODELLING

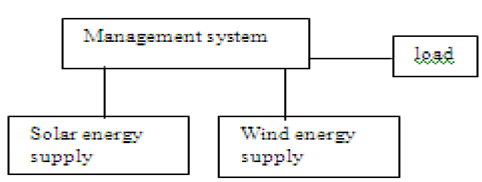

Figure1.Functional block diagram of overall system module.

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III. SYSTEM ANALYSIS

As shown in Fig 1, the proposed Prediction system consists of many parts: sensors, renewable energy supply hardware, management system.

The system first samples and collects current and voltage data from a measurement point by means renewable energy supply hardwareplant model. After the hardware plant model gathers the raw data, the data is sent to the neural network predictive controller,Then, the neural network predictive controller regulates and analyzes the data with a MATLAB-file and a MATLAB & Simulink model. After all processesare completed, the results of analysis are sent to a management system. After this point, management system regulates the power flow operation either through solar energy supply or wind energy supply.

The technical details of each part will be discussed in the following sub-section

A.DATA ACQURIED:

Annual average of solar radiation is 4.98(KWh/m^2)

September - 4.83

October - 4.54

November - 4.65

December - 4.99

Annual Average wind Speed is 3.93(m/s)

September -3.90

October - 3.00

November- 3.21

December- 4.06

B.RNNMODELLING:

The recurrent neural network comprises

$$\frac{du(t)}{dt} = -\alpha A^T \mathrm{Ax}\ (\mathrm{t}) + \alpha A^T b - \beta e^{-\eta t} \mathrm{c}\text{-}(1)$$

Parameters $\alpha, \beta, \boldsymbol{\eta} \geq \mathbf{0}$

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$A = \begin{bmatrix} sint & cost \\ -cost & sint \end{bmatrix}$is the time varying matrix.

$x = \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$isthe voltage magnitude matrix.

$b = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$is the column vector matrix.

$c = [c_1 c_2]$is the row vector matrix.

C.NN PREDICTIVE CONTROLLER

The neural network predictive controller that is implemented in the MATLAB software uses a neural network model of a plant to predict future plant performance. The controller then calculates the control input that will optimize plant performance over a specified future time horizon. The first step in model predictive control is to determine the neural network plant model (system identification). Next, the plant model is used by the controller to predict future performance.

IV. SIMULATION RESULTS

This paper involves training of elman neural network. This is simple recurrent neural network with inputs of solar irradiance and wind speed. The training is done with the help of MATLAB software by creating a m-file. Theresults of the network training is shown in this paper.

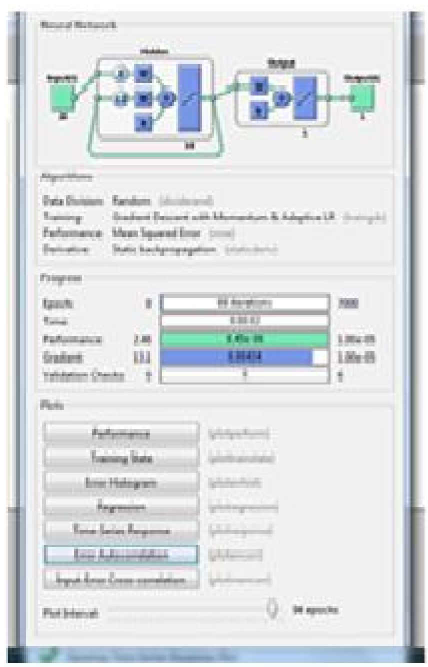

Figure 2.Recurrent Neural Network training.

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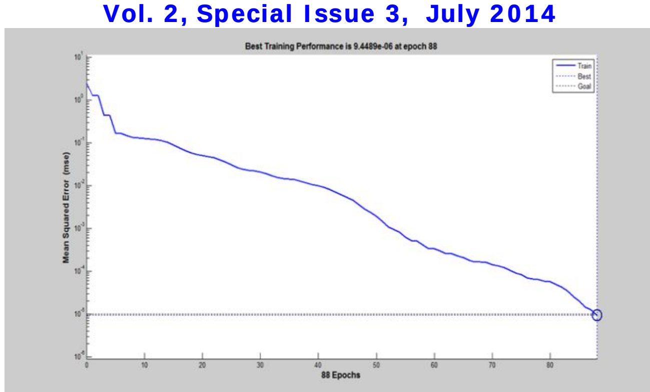

Figure 2.a) Performance of RNN at 88 epoch.

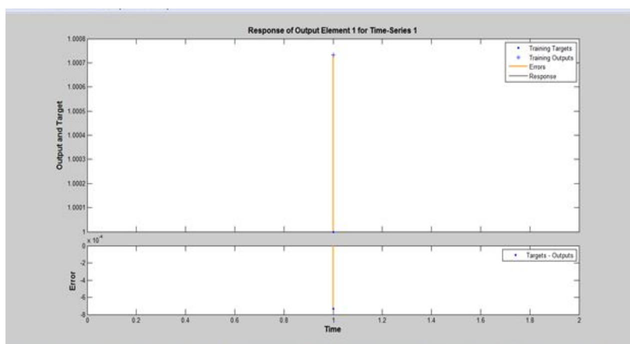

Figure 2.b) Time-series of first element.

The solar cell power module consists of a constant solar irradiance with value assigned to 1000.the solar cell is connected with a current sensor and voltage sensor to measure the current and voltage generated by the solar cell. Scope is connected to view the generated current and voltage. The solver configuration block specifies this global information and provides parameters for the solver that your model needs before you can begin simulation. The measured voltage and current is shown in the scope simulation

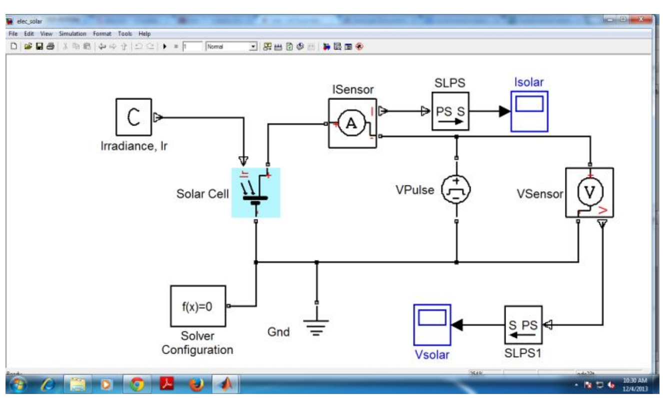

Figure 3.MATLAB & Simulink model for analyzing solar cell voltage and current

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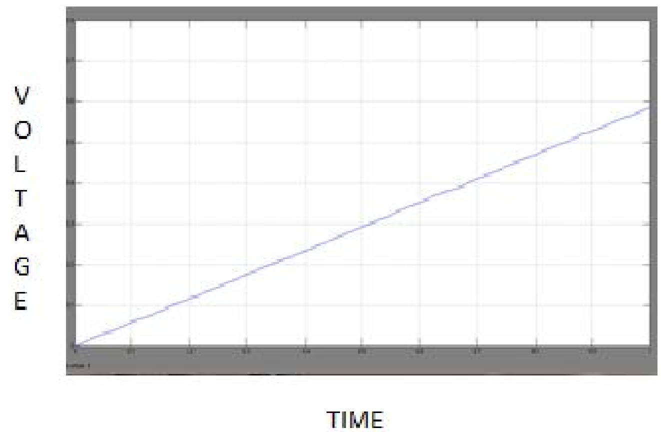

Figure 3a).Output (voltage measurement)

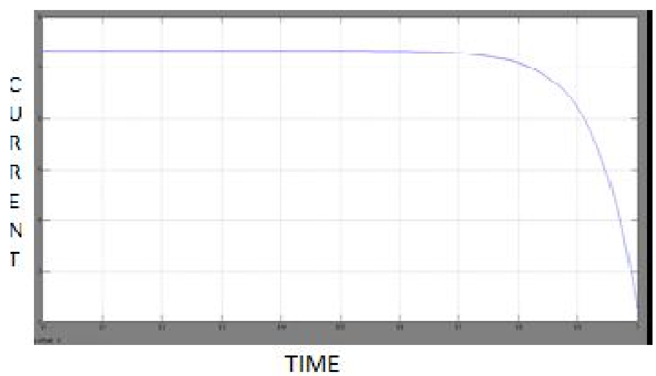

Figure 3 b).Output (current measurement)

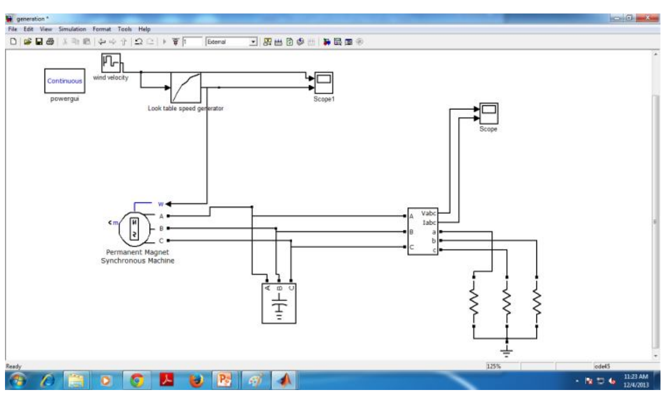

Figure 4.simulation of windpower module

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The wind velocity is given as the input to the look table speed generator.

The look table speed generator is connected to the scope which shows the output in voltage and current. A lookup table block uses an array of data to map input values to output values, approximating a mathematical function. Given input values, the Simulink software performs a "lookup" operation to retrieve the corresponding output values from the table. If the lookup table does not define the input values, the block estimates the output values based on nearby table values. The output of the generator is taken as an input to the permanent magnet synchronous machine. The output is connected to the line capacitance and is also connected to the VI measurement and is then connected to the scope for plotting the graph.

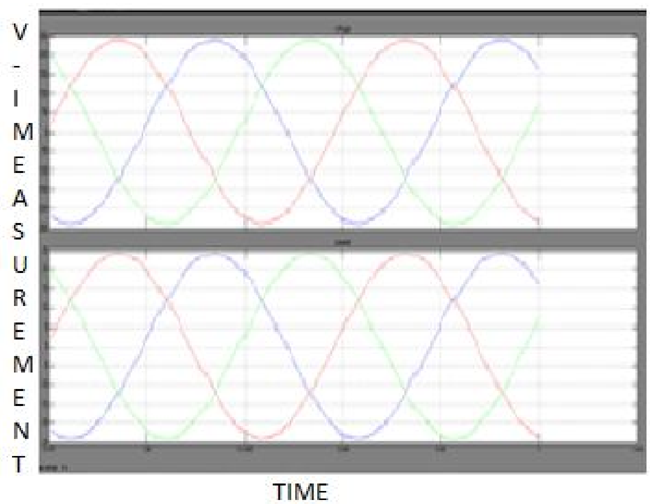

Figure 4.(a)The measured 3 phase VI measurement is shown in the above output graph.

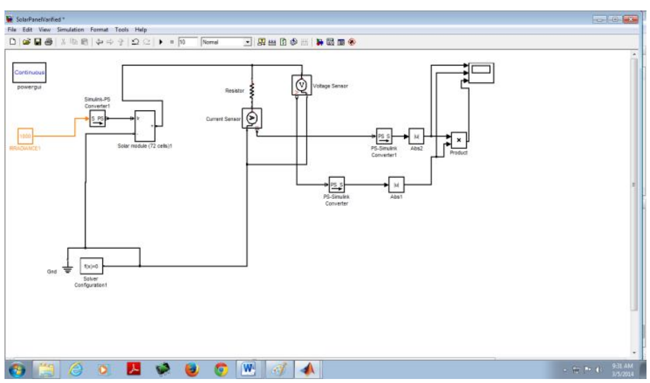

Figure 5.MATLAB & Simulink model for analyzing 72 solar cell voltage and current

Instead of using a single solar cell power module we are using a sub-system module consisting of 72 solar cells with value assigned to 1000.The sub-system is connected with a current sensor and voltage sensor to measure the current and voltage generated by the solar cell. Scope is connected to view the generated current and voltage. TheSolver Configuration block specifies this global information and provides parameters for the solver that your model needs before you can begin simulation. The measured voltage and current is shown in the scope simulation.

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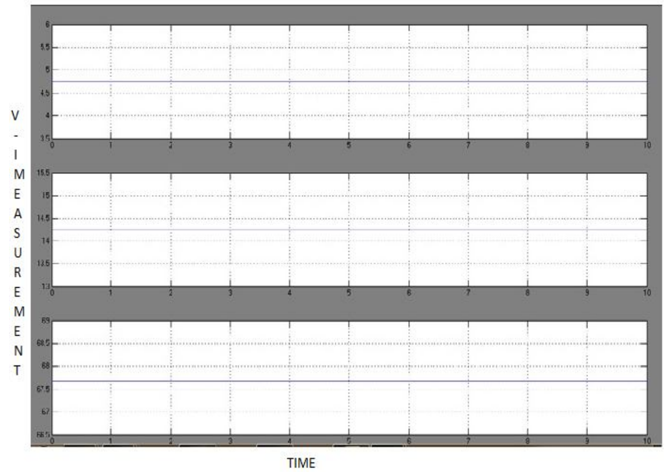

Figure 5(a) The measured V-I measurement is shown in the above output graph.

V. CONCLUSION

In this paper, we evaluated the control method using re-current neural networks for the solar wind power generation systems. The method was evaluated by the simple solar wind power generation systems.

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