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INTELLIGENT MPPT CONTROL FOR WIND ENERGY CONVERSION SYSTEMS BASED REINFORCEMENT LEARNING

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Abstract: This paper proposes a reinforcement learning (RL) method based maximum power point tracking (MPPT) algorithm for wind energy conversion systems (WECS).Due to the non-linear properties of the wind generator, the architecture takes the MPPT approach to track the effective power generated from the wind systems.This article presents the design in MATLAB/Simulink for WECS.Since RL helps the WECS to improve by direct interaction with the atmosphere, it requires no information of wind turbine specifications or wind velocity information.The key part of this role is the DC-DC model that is built in very detail, which enables the performance of the MPPT controller to change the voltage input of the converter to control the highest wind power system point.

Keywords: WECS, dc-dc conversion, MPPT, RL method

I. INTRODUCTION:

Demands are now increasing rapidly for clean energy resources. Wind power and solar resources are the most common. These also provide free and safe benefits. However, compared with renewable energy of solar, wind energy prices are lower while the installation. The key issue with wind turbine is that it has an intermittent supply and thus other power supplies can sustain it.

The systems for WECS use a wind turbine and an energy conversion system to transform wind power into various sources of electrical energy. Due to its small dimensions, highly energetic density, low maintenance requirements and easy control, the PMSGs are becoming increasingly common.The wind power system's output voltage varies with the airspeed. Because the wind turbine is not predictable, it is a challenge to continuemost wind power outcome at all wind speeds. Thorough research exists on methods for monitoring the optimum wind energy point known as the MPPT algorithm.Due to the non-linear properties of the wind generator, the architecture takes the MPPT approach to track the effective power generated from the wind systems.

The WECS system, evaluate and quantify the optimal speed ratio for both wind speed and rotor speed. T he flawless logic control is used by the function insensitivity to increase efficiency. This is an easy form, but has the disadvantage such as the correct value of wind direction is complicated and costly and the TSR relies on the features of the wind energy system.The TSR control has high precision and rapid response. Its efficiency depends even so mainly on the knowledge about wind speed. Anemometers could be used to estimate airspeed. However, this affects the price of the WECSs for capital, installations and operations. In addition, for highly efficient MPPT control, the observed wind speed may not have been precise. So that, wind speed prediction approaches were developed to fix complex issues of using sensors.

The purpose of the agent in RL is always to find a strategy of action selection to optimize the agent's overall anticipated result in the future. A status valuation or an activity value function specifies the expected return. The cost function evaluation is the cornerstone of virtually every RL algorithm.

II. PROPOSED SYSTEM:

Fig. 1 shows the arrangement of the WECS for use of the Mppt controller. The turbine is connected to the PMSG immediately. Especially in comparison with other turbines, it would have the benefit that the PMSG is attached directly to a wind turbine without any gearbox; the excitation current is not required also for DFIG category and that there is no immediate grid connection for grid tie applications. The generator and grid are connected directly to a wind turbine without a gearbox. The boost converter is step up the output dc link voltage which is powered the inverter.

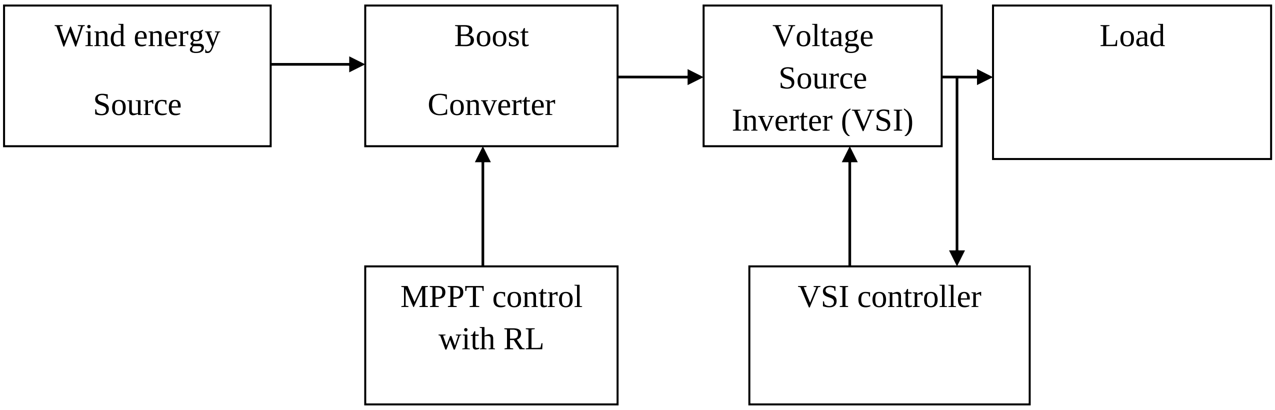

Fig.1Proposed block diagram

In comparison to the supervised learning in which the agent observes from feedback from an external supervisor, an agent in the RL is capable of drawing from their own interactions through behavior, states and awards directly communicating with the situation. Every time the agent gets a reward action is being taken to transit between states. The goal of the RL is to map states to actions so that incentives are maximized.Perturb and Observe (P & O) algorithm is an efficient strategy used for the MPPT controller. This is focused on the interruption and monitoring of the power fluctuations of the rotor speed in minor steps. The PMSG is proportional to the torque and rotating rpm to its voltages and currents. This allows the rotor speed to change by disturbing or changing the voltage and frequency. The duty cycle (PWM signal) of the power converter could've been regulated to affect the voltage.P&O method process flow shown in Fig.2.The P&O algorithm is performed by changing the boost converter duty ratio, thus changing the generator's electrical output, and evaluates the subsequent control signal growth or reduces the energy.

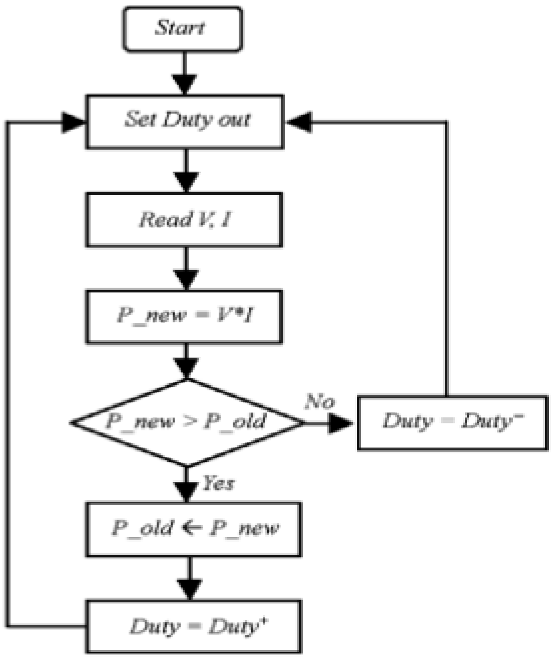

Fig.2 MPPT flow diagram

If the improvement in the PWM signal results in an enhanced in energy, the disturbance signal direction is the same in the last cycle. If the disturbance duty cycle results in a power decrease, the disturbance signal position is the inverse to the previous cycle.Initialize the function variables and take measurements of the dc-link voltage and the dc power (inductive current). The voltage and current samples (and consequently the power), depending on the system's reaction time, are obtained. The process slows down and hits a new running point when the MPPT algorITM chooses to raise the current power, which means a longer load torque. Depending on speed changing, the rectified dc-link voltage varies. A new degree of dc-link voltage with the new current inductor would provide a new point of dc power used within the calculations of the algorithm.

III. SIMULATION AND RESULTS:

The proposed system simulink model is shown in fig. 3 in which the grid stability is achieved and the disturbances in the load voltage and current are reduced using the proposed control method of RL based MPPT controller. The proposed system consists of DC-DC boost converter to extract the source power from the rectified wind system and fed it to the load connected inverter system. To make a DC bus bar voltage at constant the MPPT technique based RL controller is used.

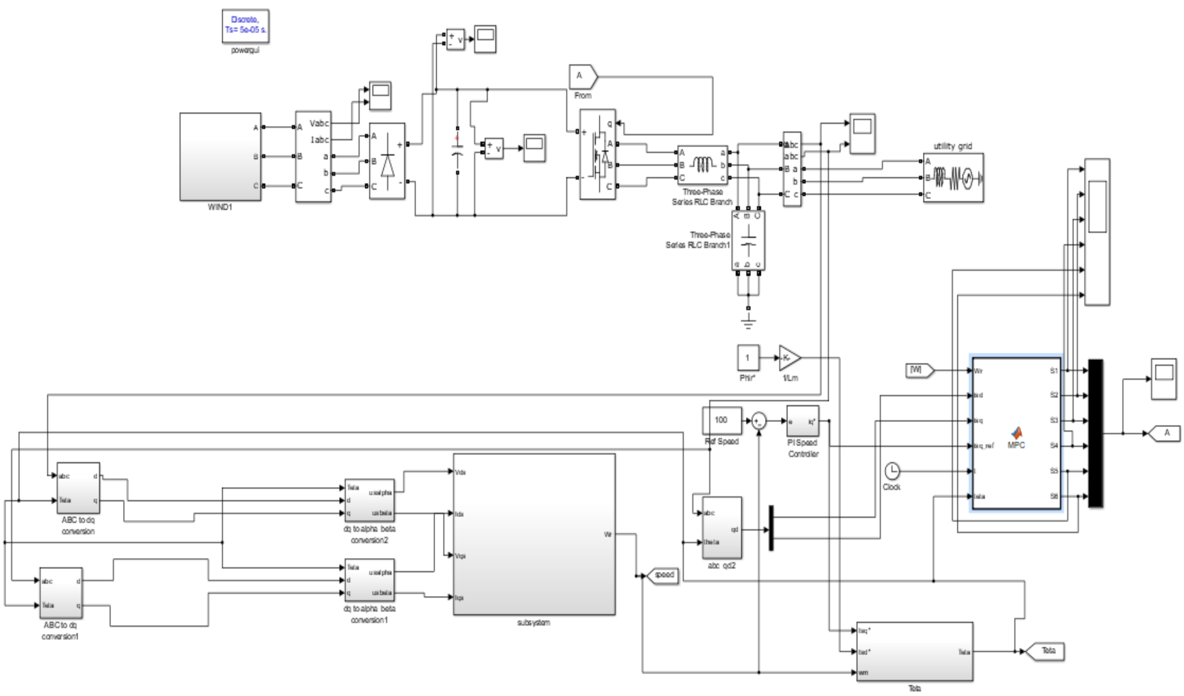

Fig. 3Simulink model of proposed system

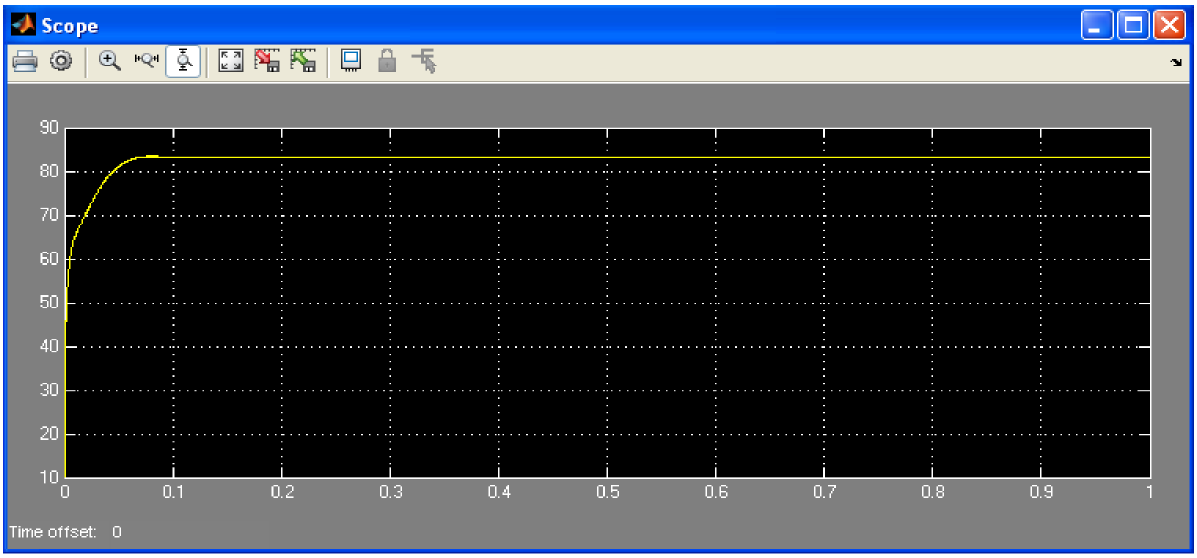

Fig. 4 DC link voltage of boost converter

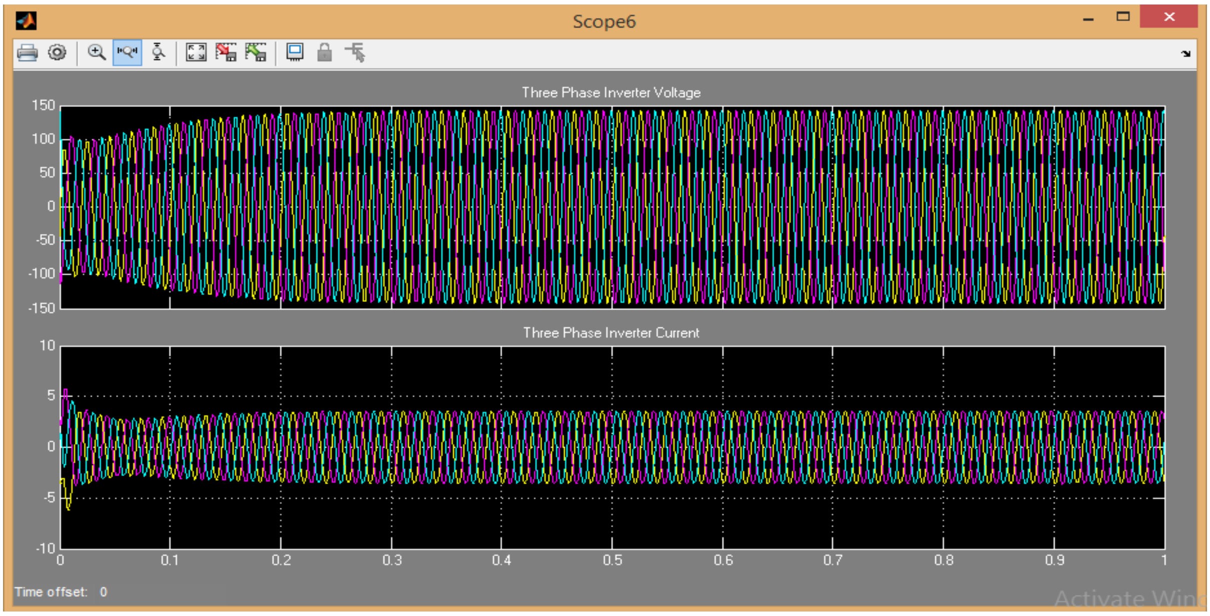

Fig. 5 Grid voltage and current

IV. CONCLUSION:

In this paper, the AC load is interfaced with the renewable power source of wind system and the boost converter is utilized and achieved the improved the input PV supply by using the controller of MPPT based RL controller. The AC load is connected with DC bus bar through the three phase inverter which is converting DC to AC power conversion. The load voltage and current are balanced by using the proposed control of RLMPPT control. The boost converter is accomplished the reduction in fluctuations in the power flow. The boost converter is regulating the DC link voltage. The efficiency of the proposed system is increased and the results are verified using MATLAB/Simulink.

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