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## Internal Quality Assurance Cell

## DVV Clarifications

**3.3.1 Number of research papers published per teacher in the Journals notified on UGC care list during the last five years**

**Findings of DVV**

HEI input changed as per proofs provided.

Publication in the current UGC CARE with ISSN are only considered.

**Response of HEI**

Publication in the current UGC CARE with ISSN are Provided

**Number of research papers in the Journals notified on UGC CARE list year wise during the last five years.**

| Session | HEI Input | DVV suggested Input | Change Input |
|---|---|---|---|
| 2022-23 | 12 | 00 | **01** |
| 2021-22 | 7 | 2 | **03** |
| 2020-21 | 2 | 1 | **01** |
| 2019-20 | 1 | 0 | **01** |
| 2018-19 | 0 | 0 | **0** |

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## Session 2022-23

### Number of research papers published per teacher in the Journals notified on UGC care list

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|---|---|---|---|---|---|---|---|---|
| | | | | | | Link to website of the Journal | Link to article / paper / abstract of the article | Is it listed in UGC Care list |
| Wind turbine electrohydraulic transmission system control for maximum power tracking with pump fault | Neeraj Kumar | ME | SAGE Journal | 2023 | 0959-6518 | https://journals.sagepub.com/ | https://journals.sagepub.com/doi/10.1177/09596518231155691?icid=int.sj-abstract.similar-articles.3 | yes |

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SAGE

# Wind turbine electrohydraulic transmission system control for maximum power tracking with pump fault

**Neeraj Kumar, Paladugu Venkaiah, Bikash Kumar Sarkar and Subhendu Maity**

**Abstract**

The wind power generation system plays a significant role in the power sector as it is an environment-friendly green power system, increasing power demand, and technological development in wind power systems. Wind turbine systems are exposed to the harsh environment with continuous variation of wind speed with gusts causing damage and failure in system components along with the fluctuation of generated power. The hydrostatic transmission system has become one of the promising solutions over the gear transmission system for transmitting power from the turbine rotor to the generator. Further to reduce power generation costs in wind power systems, a suitable control system with parametric uncertainty and system fault plays a significant role. In this study, the 5 MW wind turbine model has been developed with the combination of blade element momentum theory and the electrohydraulic transmission system model. Moreover, the wind turbine system model has been imposed fault in the pump of electrohydraulic transmission system. The proposed wind turbine system model has been validated with the existing result. The blade element momentum theory has been used to estimate the optimum pump turbine couple rotational speed for maximum power tracking. Double loop controller has been used for wind turbine power transmission system control. The first controller loop has been used for pump and wind turbine system speed control for maximum power tracking, as a passive fault tolerance controller and the second control loop for motor and generator system speed control to regulate the frequency of the generated power. Interval type 2-fuzzy proportional–integral–derivative controller are suitable for high degree of uncertain system like wind power system due to their footprint of uncertainties. Proper choice of footprint of uncertainty provides robust performance against uncertainties and dynamic performance. Hence, the primary and secondary controller has been developed as interval type 2-fuzzy proportional–integral–derivative with inertial weight local search–based teaching–learning-based optimization controller. The inertial weight local search–based teaching–learning-based optimization interval type 2-fuzzy proportional–integral–derivative controller performance has been studied with benchmark sinusoidal test signals. The proposed inertial weight local search–based teaching–learning-based optimization interval type 2-fuzzy proportional–integral–derivative controller performance has been also compared with conventional proportional–integral–derivative and interval type 2-fuzzy proportional–integral–derivative controller. The proposed system performance has been compared with contemporary reported digital hydrostatic transmission wind turbine system and recently reported controller with consideration of fault in the pump. The proposed inertial weight local search–based teaching–learning-based optimization interval type 2-fuzzy proportional–integral–derivative controller performance has been compared through integral absolute error with interval type 2-fuzzy proportional–integral–derivative controller and recently reported proportional–integral–derivative sliding mode controller obtained as 0.0016, 0.0029, and 0.0031, respectively.

**Keywords**

Electrohydraulic, fuzzy type 2, transmission, wind turbine, teaching–learning-based optimization, inertial weight local search

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## Session 2021-22

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|---|---|---|---|---|---|---|---|---|
| | | | | | | Link to website of the Journal | Link to article / paper / abstract of the article | Is it listed in UGC Care list |
| Study of MPPT Techniques in PV Based Renewable Energy System | Ashwini Mishra | EEE | IJITE- International Journal of Innovative Trends In Engineering | 2022 | 2395-2946 | https://www.ijite.com/ | https://www.ijite.com/citations/IJITE_7403_20595.pdf | YES |
| Study of MPPT Techniques in PV Based Renewable Energy System | Samarjit Singh | EEE | IJITE- International Journal of Innovative Trends In Engineering | 2022 | 2395-2946 | https://www.ijite.com/ | https://www.ijite.com/citations/IJITE_7403_20595.pdf | YES |
| Performance analysis of the swashplate axial piston pump with hydraulic fluid temperatures | Neeraj Kumar | ME | JSIR | 2021 | 0975-1084 | http://op.niscair.res.in/ | http://op.niscair.res.in/index.php/JSIR/article/view/37201 | yes |

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*Review Article*

# Study of MPPT Techniques in PV Based Renewable Energy System

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## ABSTRACT

*Energy plays an essential role in the development process. It is almost impossible to achieve sustainable development without energy, "Since access to modern energy lies at the heart of human development. The energy requirement is increasing steadily worldwide, and this requirement is being met by both conventional(non-renewable) and non-conventional (renewable) energy sources. it is now realize that renewable energy has to be used to greater extent so as to achieve the country goals, i.e reduction of greenhouse gases and energy demand fulfilment, Due to non-availability of sufficient resources and a considerable amount of emission of pollutants from conventional sources and the increasing constraints led by the international agreement, In fact, in line with the problems and difficulties of acceptance of new technologies, there are barriers to solar energy use that cause difficulty for running and operating solar energy systems many research examinations show that a solar panel practically converts 30-40% of energy incident on it to electrical energy. To increase the efficiency of solar panel a Maximum Power Point Tracking approach is necessary. The objective of this examination to the use of photovoltaic (PV) applications are dominating in the renewable energy market today. The rise in PV application is mainly due to the improved PV efficiency and its low marginal costs. Along with this surge of PV application in today's electronic industry, the need for more efficient DC-DC converters that integrate with the PV panels are also in demand. Another important aspect is the development of a controller for the power converter board, which always ensures the maximum power out of the PV panels.*

## KEYWORDS

*Renewable Energy, Photo Voltic cell, Solar Energy, DC-DC Converters, Green Energy Generation.*

## 1. INTRODUCTION

Renewable energy is energy that can be obtained naturally. Natural resources such as sunshine, wind, tides, waves, biomass, and geothermal heat are used to create it. In contrast to fossil fuels, which are rapidly depleting, such resources are inexhaustible. Another significant issue working against fossil fuels is pollution caused by their combustion. In contrast to its conventional equivalents, renewable energy sources are recognized to be cleaner and produce energy without the adverse impacts of pollution, despite the world's increasingly diminishing stocks of fossil fuels.

The market for renewable energy technology has been steadily expanding, and renewable energy projects performed by developing countries contribute to poverty reduction. Because of mass production and market rivalry, as well as widespread adoption, renewable energy solutions are becoming more affordable.

There are various sorts of renewable energy sources, including

**a. Solar energy**

Solar energy is a significant source of renewable energy. The sun's energy is captured as heat and radiant light. Solar energy can be used to generate solar thermal energy, which is used in space heating. Solar energy may also be transformed into electrical energy, which can then be used for a variety of purposes. It has a higher initial installation cost, but it provides long-term benefits.

**b. Wind energy**

Using wind turbines, wind power is generated from wind flow. The wind's kinetic energy can be turned to mechanical energy, which can then be transferred to electrical energy. Wind turbines are used to collect energy from the wind. An air turbine's output power is exactly proportional to the cube of wind speed.

**c. Hydro energy**

Hydropower is a type of renewable energy that can be harnessed and converted into electricity and is found in flowing water. Hydropower is increasingly being used in

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# Performance Analysis of the Swashplate Axial Piston Pump with Hydraulic Fluid Temperatures

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Variable displacement axial piston pump can be used in a hydraulic system as the primary source of fluid power, which is suitable for high pressure and high efficiency. The power can be transfer in a hydraulic system with the help of the fluid medium. The oil leakage problem in various parts of the pump, especially the internal leakages in the piston-cylinder, swash plate-slipper pad and valve plate-cylinder block, seriously affect the performance of the pump. Therefore, it is important to know the properties of the fluid and its effect on the system performance. To study the performance of an axial piston pump, a non-linear mathematical model has been developed. The developed model has been validated with the existing results. The validated pump model has been used for performance analysis of the system. Moreover, the influence of hydraulic mineral oil at different temperatures on the piston chamber pressure, output power, and leakage flow in piston-cylinder has been explored. The present investigation has been performed in MATLAB Simulink 14a environment. The simulation result shows that the pump operating temperature range can be set as 30°C to 60°C for moderate ripple and output chamber pressure.

**Keywords:** Hydraulic system, Bulk modulus, Chamber pressure, MATLAB Simulink

## Introduction

The swash-plate type axial piston pump can be used in a hydraulic system as the main fluid power source. In fluid power systems, power is transferred through hydraulic oil, therefore the oil properties like density, viscosity, and bulk modulus affect its dynamic performance. Apart from hydraulic oil properties, oil leakage also affects the performance of the hydraulic system.[1] Various types of hydraulic oil can be used for fluid power systems based on their properties. Hydraulic systems suffer from huge energy loss as they operate at high pressure. Researchers are attracted to energy efficiency research of hydraulic systems. The dynamic performance of hydraulic system degrades due to leakage of hydraulic fluid in the system while operation and variation of oil properties due to change of oil temperature.[2-4]

Many previous researchers have reported on the reduction of pressure ripple and flow ripple using groove geometry and different controller design. Only a few have studied the temperature analysis on chamber pressure and output power of an axial piston pump by using different hydraulic fluids. Kim *et al.* (2003)[6] conducted an experiment on the axial piston pump to measure the fluid film thickness on the valve plate using hydraulic oil as a fluid medium. Javalagi *et al.* (2012)[7] studied the different hydraulic fluids available and their effect on system performance. They found that for low dynamic viscosity, the efficiency of the system decreases. The noise of the system has been significantly reduced by using mineral oil and synthetic oil. Recently, Song *et al.* (2018)[8] reported research on the influence of temperature on piston-cylinder interface leakage in an axial piston pump. The efficiency of the axial piston pump decreases with increase in temperature as contact time increases monotonically in the form of hyperbolic tangent. Kazama (2009, 2015)[9,10] and Kazama *et al.* (2010)[11] used thermocouples amplifier for measurement of temperature on bearing and seal parts of variable displacement pump. They have considered mineral oil of VG22 and a water-glycol having a temperature range of 20 to 40 degrees. Finally, they concluded that temperature raises much less using water-glycol-oil as compared to mineral oil. Cai *et al* .(2015)[12], Feo *et al.* (2015)[13], and Cancino *et al.* (2018)[14] studied the effect of hydraulic oil temperature on tribological behavior of steel-steel contact and performance of engine lubricated at higher temperature respectively. Along with that, Borghi *et al.* (2009)[15] and Tang *et al.* (2017, 2018)[16,17] investigated numerically the dynamic behavior of axial piston pump, motor slipper bearings,

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| Evaluation of ANN, M5P, RBF, Reptree for Runoff and Sediment Yield | Sanoj Kumar | CE | IJSTR | 2020 | 2277-8616 | https://www.ijstr.org/ | https://www.ijstr.org/final-print/apr2020/Evaluation-Of-Ann-M5p-Rbf-Reptree-For-Runoff-And-Sediment-Yield.pdf | yes |

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# Condition monitoring of hydraulic transmission system with variable displacement axial piston pump and fixed displacement motor

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ABSTRACT

Electrohydraulic power transmission systems are used in industries, automobiles, mining, aircraft, wind turbine system, machine too etc. To increase safety and reliability, it has become essential to know the health of the system components. So, fault detection of transmission system components has become necessary to reduce maintenance costs and prevent accidents. The leakage based health monitoring of a transmission system with variable displacement axial piston pump and fixed displacement hydraulic motor has been studied. In the present investigation, an axial piston pump of the transmission system has been analyzed for health monitoring. Mathematical modeling of the transmission system has been carried out in details. The wear between piston and cylinder bore has been considered as the primary cause of fault. The deviation of flow characteristic from normal flow due to increased leakage gap has been considered as a parameter for pump health monitoring. The performance of the transmission system has been studied due to variation pump leakage flow due to increase leakage gap. The present investigation has been carried out through a simulation study in Matlab Simulink environment.

Selection and Peer-review under responsibility of the scientific committee of the International Mechanical Engineering Congress 2019: Materials Science.

## 1. Introduction

The industrial automation and integration of machines in a common platform through the internet of things has become recent trends of development. The integration of the different devices in a common platform can be executed through sensor integration and proper controller design. To improve productivity in the industries, health monitoring plays a significant role. Recently researchers are reported significant contributions towards condition monitoring [1–5] of system components in manufacturing industries. The electro-hydraulic power transmission system can be used in industries, automobiles, mining, marine system, wind turbine system, hybrid vehicles, military, machine tool technology, etc. The electro-hydraulic power transmission system can be used for short distance and high power transmission condition. The advantages of the hydrostatic power transmission system are robust, good controllability, high power to weight ratio, the self-lubrication property so forth. The critical components of the modern power transmission system are positive displacement hydraulic pump, hydraulic motor, control valves, and prime mover such as electric motor, IC engine to drive pump, control system, other accessories like sensors, data acquisition system, etc. In industrial applications, it has become very much essential to monitor the health of the transmission system and its components. Some researcher has reported research on health monitoring of hydraulic transmission system. Among those, Zhao [6] reported condition monitoring of hydraulic crane for tilting, rotating, feeding operation by vibration signature. During the last fifty years, few researchers have limited attention to condition monitoring of the hydrostatic transmission system and its component performance. Li [7] reported condition monitoring of the axial piston positive displacement pump. Athanasatos et al. [8] bond graph approach for fault diagnosis of the hydraulic system through internal leakage detection.

Moreover, Razavi [9] put forward on Kalman filter for health monitoring, which has a model-based online health monitor for hydraulic automatic fish processing machines. Some researchers have reported the simple mathematical modeling of the closed-loop hydrostatic transmission system. Although, Mandal et al. [10] developed the detailed modeling of an axial piston pump to

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| Condition monitoring of hydraulic transmission system with variable displacement axial piston pump and fixed displacement motor | Neeraj Kumar | ME | science direct | 2020 | 2214-7853 | https://www.sciencedirect.com/ | https://www.sciencedirect.com/science/article/abs/pii/S2214785320370371?via%3Dihub | yes |

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# Evaluation of ANN, M5P, RBF, Reptree for Runoff and Sediment yield

**Sanoj Kumar, Birendra Bharti, H.P. Singh**

**Abstract:** There are many water resources problems are the nature of prediction and estimation of rainfall, runoff, contamination concentration and water stages etc. Solving these problems with the conventional techniques are computationally expensive and far from the real-life situation. It is most useful for watershed management. In the present study, runoff and sediment yield are evaluated respectively by different model on the Nagwan watershed. This watershed is located on the upper part of the Sewani River in Hazaribagh district of Jharkhand. The input parameters rainfall, temperature, relative humidity, wind velocity, dew point and output parameters are runoff, sediment yield. The monthly data from 1983 to 2006 are used for training and from 2007 to 2016 are used for testing. For the prediction of runoff and sediment yield different type of models are used i.e. ANN, M5P, RBF, Reptree. In the present study model evaluation criteria i.e. NSE, CC, RSR, Pbias, R^2 are calculated. The value of NSE,CC,RSR,PBIAS and R^2 of Runoff are found as 0.99, 0.98,0.30, 0.15, 0.99 during calibration and 0.98, 0.98, 0.45, 0.56, 0.98 during validation and the evaluation criteria of NSE,CC,RSR,PBIAS and R^2 of Sediment Yield are found as 0.99, 0.98, 0.46, 0.67, 0.99 during calibration and 0.98, 0.96, 0.58, 0.02, 0.98 during validation. In this study we found that predication of runoff and sediment yield value M5P model is the best model. Keywords: M5P, ANN, RBF, NSE, CC.

## 1 INTRODUCTION

The hydrological phenomena, the variation due to runoff and sediment yield in the catchment. A linear and non linear hydrological models have been developed in 1930 for explaining the processes of rainfall , runoff and sediment yield in the watershed and these very useful for the prediction .Many parameter s are required to process the hydrological model like surface roughness, watershed treatment, conservation practices , soil moisture variation , soil horizon ,topographic data , watershed treatment, land uses, soil characteristics etc.For describing the hydrological model following assumption are made , 1) Uniform soil group 2)uniformly distributed over the catchment is sediment produced in the catchment 3)Slope approximations ,etc.The assumptions are very useful for the development of classical model. Apart from that, ANN based approach method is very flexible for the determination of catchment characteristics. The artificial neural network(ANN) approach includes both linear and non linear concepts for the development of model . The ANN model minimises the error effectively. Kumar et al. (2002) investigated utility of ANN for the estimation of daily reference crop evapotranspiration and compared the performance with the conventional method (24). Kim et al. (2003) used ANN to forecast draught and the result indicates that the conjunctive Models significantlyimprove the ability of ANN to forecast the indexed regional draught (23). Jain et al. (2004) applied knowledge of ANN to analyze the soil water retention data (21).

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Kumar et al. (2005) used artificial neural networks (ANNs) in rainfall-runoff modelling has suggested certain issues that are still not addressed properly (33). Sarangi and Bhattacharya (2005) developed for the prediction of sediment yield were validated using the hydrographs and silt load data of 1995–1998 for the Banha watershed in the Upper Damodar Valley in Jharkhand state in India (32) .Raghuwanshi et al. (2006) developed to predict both runoff and sediment yield on daily as well as weekly basis from simple information of rainfall and temperature (30). Upadhayay et al.(2009) predicted Runoff and sediment yield from an Indian watershed during the monsoon period were forecasted for different time periods (daily and weekly) using the back propagation artificial neural network (BPANN) modelling technique(4). Goyal (2014) predicted the sediment yield generated within a watershed is an important input in the water resources planning and management (29). The focus of present study is to evaluate the performance of ANN, M5P, RBF, Reptree for Runoff and Sediment yield in Nagwan watershed of the upper part of the Sewani river in Hazaribagh of Jharkhand.

## 2 STUDY AREA

The Nagwan watershed is located at the upper part of the Sewani river between 85.2500 to 85.4300 E longitudes and 23.9900 to 24.1200 N latitude within the Damodar-Barakar catchment in India. The watershed is just 7 km from the soil conservation department of D.V.C. at Hazaribagh, Jharkhand. The catchment is rectangular in shape with an area of 92.46 sq. km shown in figure1. Geologically, the area is quite complex, having rocks of varying composition, the soils of the area are mainly of clay loam type. The maximum and the minimum elevations of the area are 637 m and 564 m, respectively from mean sea level. The catchment has very undulating and irregular slope varying from 1 to 25%. The area experiences sub-humid sub-tropical monsoon type of climate, characterized by hot summers (4000C) and mild winters (400C). The total annual precipitation of 1200 mm is distributed mainly between June to September. The mean monthly relative humidity varies from a minimum of 40% in the month of April to a maximum of 85% in the month of July.