# Control System for Wind Power Plant

[1]Shweta Gaur [2]Dr. Brijraj Singh Solanki

[1]Bachelor's student, [2]Assistant Professor
Department of Electrical Engineering,
Poornima College of Engineering, Jaipur, India

***Abstract*: The variations and uncertainty of wind speed is the major problem of wind energy generation plant. To increase the characteristics of energy produced by wind power plant, many control strategies and techniques are developing for wind turbine. To expand the standard of power we are controlling pitch and yaw system when air currents is above the assess speed. Pitch angle is controlled through multi layer perceptron as well as radial basis neural networks. Yaw system is controlled through fuzzy PID method.**

***Index Terms*: Multilayer Perceptron, radial basis neural networks, fuzzy PID Control system, pitch and yaw control.**

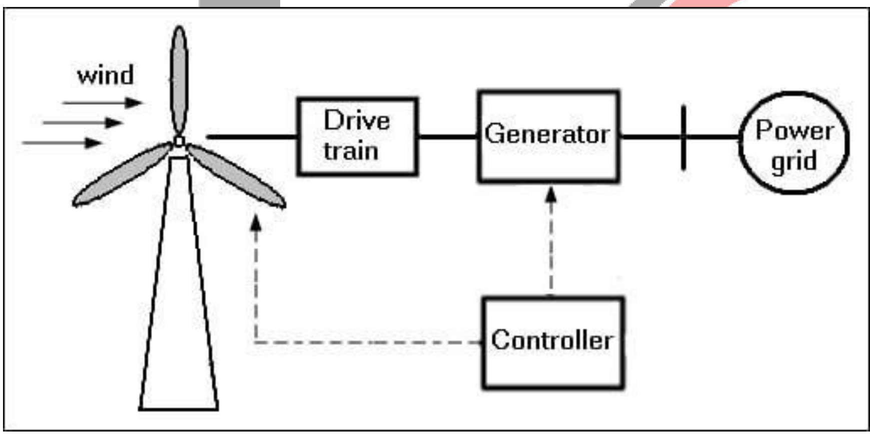
## I. INTRODUCTION

The main application of wind power plant is as distributed power plant. The cost, environmental effects, controlling, etc is the major disadvantages of non-renewable power plants. Due to bad impacts of non-renewable energy sources like air pollution, water pollution, acid rains, greenhouse effect, the trending of non-conventional sources has been growing all around the world. In the future, the application of wind turbine increases in offshore and communal applications. New different technologies are increasing to improve the quality of output of wind power plant by controlling pitch and yaw system. Torque regulation and produced power of turbine rely on air currents variations. When the speed of wind reaches above the rated wind speed, the yielding power should be controlled by decreasing the aerodynamic coherence of wind turbine to prevent the wind turbine from overburden. So, to get proper output power pitch angle and yaw system must be controlled.

## II. PITCH ANGLE CONTROL

An acceptable pitch angle for constant operation can produced with the help of error difference of shaft speed as well as desired speed. The difference of actual power as well as desired power is used to control the pitch for continuous power.

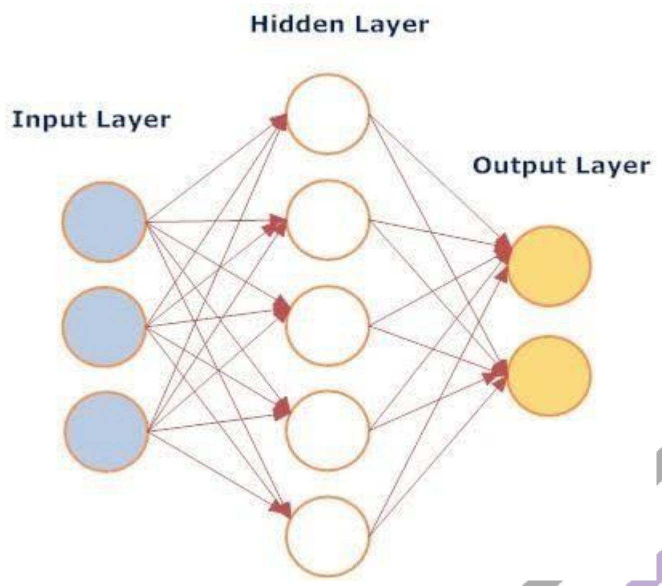
BLOCK DIAGRAM OF WIND ENERGY CONVERSION SYSTEM CONFIGURATION




## III. MULTI LAYER PERCEPTRON NETWORK

In science and engineering problems MLP neural networks is applying because of learning algorithms like error back propagation algorithm. In this technique delta rule is need as learning rule, and weights are recondition according to the delusion between the network productivity and necessary output. For this reason this algorithm is called as back propagation algorithm.

STRUCTURE OF A MLP NEURAL NETWORK WITH ONE HIDDEN LAYER




**Following are steps for pedagogy process for this algorithm:**

1: Initiate all of the weights randomly

2: Compute produced vector

3: compute error generating values.

4: renovate the weights.

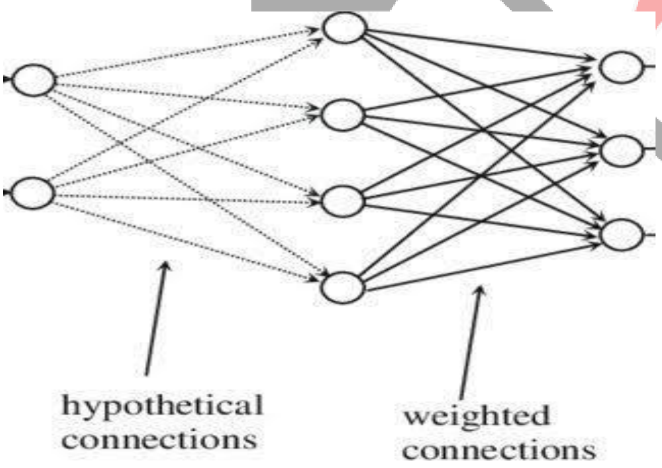
5: compute the aggregate error.

6: repeat the calculation by come back to rule 2 till the overall error is not as much the expected error.

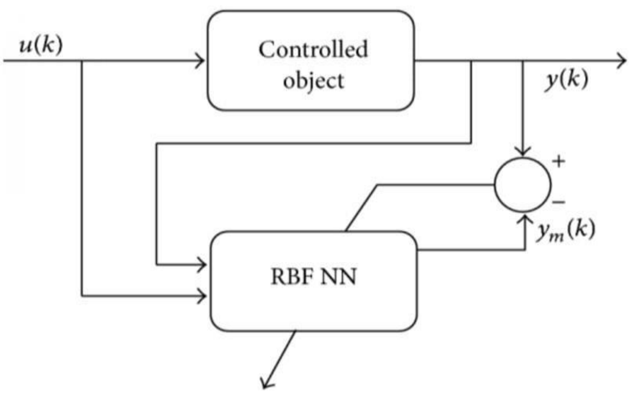
**Radial basis function networks**

It contains three layers. The three layers are input layer, hidden layer as well as output layer. The neurons inside each layer are entirely connected to preceding layer neuron. The connections between input as well as hidden layer have not some weight coefficient. So, hidden layer neurons receive the input variables unchanged.

STRUCTURE OF A RADIAL BASIS FUNCTION NETWORKS



**Proposed neural network controller**




**Following are the rules for indoctrination process of it.**

Rule 1: Initiate over all weights inconsistently.

Rule 2: Compute every element of produced output vector.

Rule 3: Compute the error value of every neuron in output layer

Rule 4: Update overall weights

Rule 5: Evaluate the overall error

Rule 6: Repeat the calculation by come back to rule 2 till the overall error is not as much the expected error.

### YAW SYSTEM CONTROL

It consists of control system of yaw as well as drive system of yaw. It is an anomalous servo system in wind power plant allows wind disc to trail air currents direction. The angle between wind direction as well as wind speed subsist, control system modify the wind disc to incline in the same direction of air currents.

### FUZZY PID FOR YAWSYSTEM

FRAMEWORK OF FUZZY PID

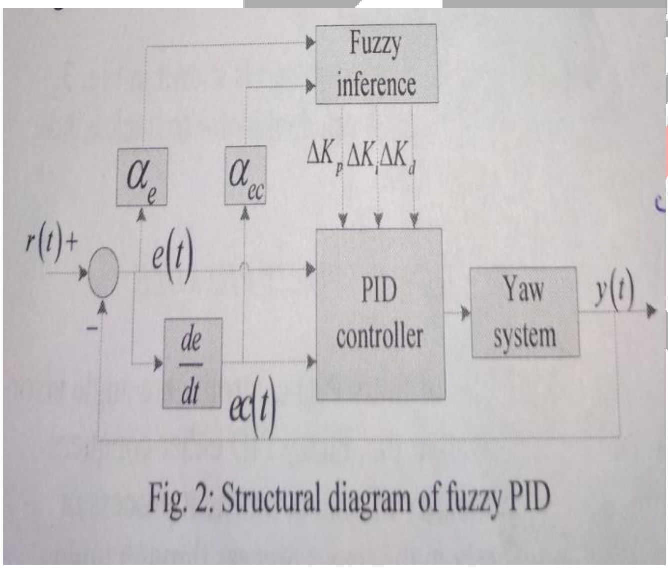


Fig. 2: Structural diagram of fuzzy PID

Compound controller includes fuzzy controller as well as traditional PID.

Predominantly, input as well as output variables of controller are fixed as stated by characteristics as well as requirement of controlled device.

Then, the membership function as well as domain of input as well as output is selected. Further the input variables are fuzzified as well as fuzzy inference rule is drafted. At last, the output variables are defuzzified.

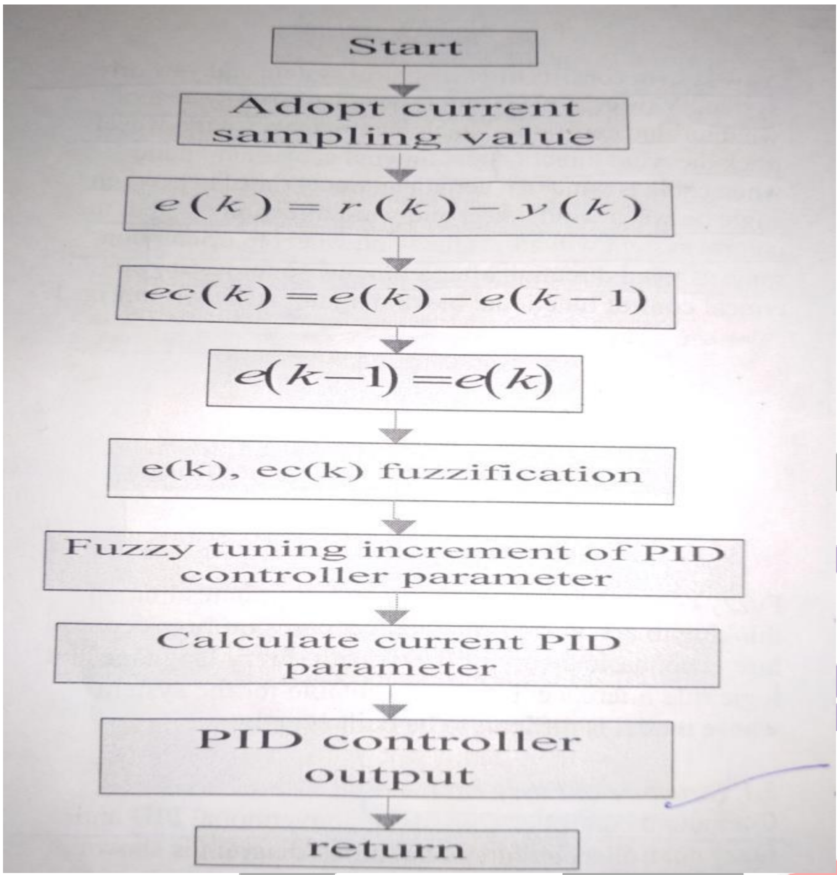
$$K_P(K) = K_{P0} + K_P(K-1)$$

$$K_I(K) = K_{I0} + K_I(K-1)$$

$$K_D(K) = K_{D0} + K_D(K-1)$$

Where $K_{P0}$, $K_{D0}$, $K_{I0}$ are the initial parameter values of PID controller, $K_P(K)$, $K_I(K)$, $K_D(K)$ are PID parameter value on K time, $K_P(K-1)$, $K_I(K-1)$, $K_D(K-1)$ are parameter increment of PID controller on K-1 time.

WORKFLOW OF FUZZY PID CONTROL




The result of defuzzification is proceeding on motor for trail wind direction.

The task of proportional coefficient $k_p$ is to extent the system retaliation and to increase precision. The gigantic its value the faster is the device response as well as regulation.

The task of integral coefficient $k_i$ is to remove the steady state error. The higher its value the rapid is the eradicated process of device static error.

The task of differential coefficient $k_d$ is to boost the device dynamic feature.

**CONCLUSION**

Fuzzy PID controller technique is used in wind turbine to circumvent the consequence of distraction as well as unreliability. This control technique improves the device reaction and control accuracy to extend the device staging. Framework of fuzzy PID is easy as well as simple to implement. Multi-layer perceptron and radial basis neural networks technique in pitch angle of wind turbine improves the system response and accuracy.

**REFERENCES:**

www.jscse.com
cdn.intechopen.com
Submitted to national university of Singapore