

**AN INVESTIGATION OF CONTINUOUS VARIABLE
TRANSMISSION APPLICATION IN WIND TURBINE**

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ABSTRACT

The goal of this research is to investigate the possibility of using a continuous variable transmission (CVT) in a wind turbine application. The propose of simulation is to see whether a CVT can be used to let the rotor speed follow the wind speed profile and thus keeping the tip speed ratio, λ constant. Working principle of continuously variable transmission (CVT) applying in wind power system is analyzed. Mathematic model of CVT in wind power is established. The relation between wind energy utilization coefficient (C_p), power and wind speed are studied. The CVT, wind turbine rotational speed, wind energy utilization coefficient, generator's rotational speed, wind turbine power and generator power are simulated when wind speed signals are random changed. After which the design and simulation of the system was undertaken using Matlab/Simulink. Simulation results show that wind power applying CVT makes wind turbine operate at an optimal blade tip speed ratio, obtain an optimal wind energy utilizing coefficient, take full advantage of wind energy and be superior to fixed pitch wind power. Generator outputs constant frequency voltage and smoothly variable powers without applying other electric power and electronic equipments.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

The mean surface winds over Peninsular Malaysia are generally mild, with the speed of about 1.5 m/s, and a maximum speed of less than 8 m/s. With these figures, Wallington, Connecticut Distributed Energy Systems Corporation had announced the shipment of two 100-kilowatt wind power systems for installation on the Malaysian resort island of Pulau Perhentian.

The problem of energy and environments are highly concerned by mankind nowadays. The wind energy can be used about 10 MW annually all over the world [1]. It is clear that the wind energy have the huge utilizing potential. Under the condition that energy in short supply, it has the great significance to study how to make full use of the wind energy and increase the amount of wind power. The fixed pitch wind power can not always run with the optimal wind energy utilizing coefficient. However, CVT can carry out continuous and smooth the ratio transmission [2]. When the wind velocity random changes, wind power system with CVT can always operate at the optimal wind energy utilizing coefficient. Also, the generator can output voltage of constant frequency without applying other electronic equipments.

At the random wind velocity, the characteristics of system including wind energy absorbed by wind power, power coefficient, rotational speed of rotor, and tip speed ratio for the system are simulated.

In variable speed wind power systems, the turbine runs at a tip speed ratio which ensures its maximum efficiency. Variable speed systems have more advantages such as that the turbine is less sensitive to the wind pattern of a given location and emits less noise at low speeds.