



( 1 )

# Analysis of Wind Turbine Driven Permanent Magnet Synchronous Generator under Different Loading Conditions

Gaber El-Saady, El-Nobi A.Ibrahim, Hamdy Ziedan and Mohammed M. Soliman

## Abstract:

This paper proposes the configuration of a wind turbine generating system equipped with Permanent Magnet Synchronous Generator (PMSG). There are different types of synchronous generators, but the PMSG is chosen which has better performance due to higher efficiency and less maintenance. Since it can be used without a gearbox also implies a reduction of the weight of the nacelle and a reduction of costs. The model includes a wind turbine model, drive train model and PMSG model. The equations that explain their behavior have been introduced. The generator model is established in the d-q synchronous rotating reference frame. The proposed Wind Turbine Generator System (WTGS) has been implemented in Matlab/Simulink software. The PMSG is operating in stand-alone which is loaded with different types of loads. The simulation results indicate the ability of wind driven PMSG to operate over wide range of operating conditions at different loading conditions and show effect of different load types in operation.

## Keywords:

Permanent Magnet Synchronous Generator (PMSG), Wind Turbine, Wind Energy and WTGS

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( 2 )

# Analysis of Wind Turbine Driven Permanent Magnet Synchronous Generator under Different Loading Conditions

Gaber El-Saady, El-Nobi A.Ibrahim, Hamdy Ziedan and Mohammed M. Soliman

## Abstract:

This paper proposes the configuration of a wind turbine generating system equipped with permanent magnet synchronous generator (PMSG). There are different types of synchronous generators, but the PMSG is chosen in order to obtain its model. It offers better performance due to higher efficiency and less maintenance since it does not have rotor current and can be used without a gearbox, which also implies a reduction of the weight of the nacelle and a reduction of costs. Wind turbine and drive train have been modelled and the equations that explain their behaviour have been introduced. The generator model is established in the  $dq$  synchronous rotating reference frame. The PMSG is operating in stand-alone which is loaded with different types of loads. The proposed system has been implemented in MATLAB /SIMULINK software.

## Keywords:

Permanent Magnet Synchronous Generator(PMSG), Wind Turbine, Modeling, WTGS simulation and modeling.

## Published In:

16th International Middle- East Power Systems Conference -MEPCON'2014 , . . .



( 3 )

# Modeling and Operation of Permanent Magnet Synchronous Generator Wind Energy Conversion System Connected with Grid

Gaber El-Saady, El-Nobi A. Ibrahim, Hamdy Ziedan and Mohammed M. Soliman

## Abstract:

Wind is one of the most distinguished renewable sources of energy. Wind Energy Conversion System (WECS) is based on a variable speed wind turbine with direct driven Permanent Magnet Synchronous Generator (PMSG). WECS transmits its electrical power to an AC grid using advanced power electronic converter system. The modelling and operation of a grid connected wind generation system based on a gearless PMSG is being studied. Implementation of the machine side converter control strategy develop a maximum power point tracking (MPPT) method using direct driven PMSG. The grid side converter is used to control active and reactive powers injected into the grid and maintaining the dc link voltage constant. The PMSG is connected to the grid by means of a fully controlled back-to-back converter with a voltage source inverter (VSI) which consists of a pulse width modulation (PWM) and an intermediate DC link circuit. DC-Link Over-Voltage protection Scheme is used to protect the system under fault conditions. The effect of change wind speed and faults on the operation is being studied in this paper. The modeling of wind power generation system with PMSG and power electronic converter interface along with the control scheme is implemented using a MATLAB/SIMULINK simulation package.

## Keywords:

Permanent Magnet Synchronous Generator (PMSG), WECS, Fully controlled back-to-back converter, PWM, Voltage Source Inverter, MPPT

## Published In:

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( 4 )

# A fault ride through strategy for wind energy conversion system based on permanent magnet synchronous generator

Mohammed M.soliman, Gaber El-saady

## Abstract:

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