Virtual and Intensive Course Developing Practical Skills of Future Engineers

VIPSKILLS Erasmus+ 2016-1-PL01-KA203-026152

PROJECT TITLE	Wind Energy Laboratory class
OBJECT	Determination of current-voltage characteristics of the aero-generator
NAME AND SURNAME	
DATE	2018

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AUTHORS Tomasz Teleszewski, Bialystok University of Technology (BUT),

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1. Introduction

Generator

Generator (Fig.1.1) is one of the most important components of a wind energy conversion system. In contrast with the generators used in other conventional energy options, generator of a wind turbine has to work under fluctuating power levels, in tune with the variations in wind velocity. Different types of generators are being used with wind machines. Small wind turbines are equipped with DC generators of a few Watts to kilo Watts in capacity. Bigger systems use single or three phase AC generators. As large-scale wind generation plants are generally integrated with the grid, three-phase AC generators are the right option for turbines installed at such plants. These generators can either be induction (asynchronous, Fig. 1.3) generators or synchronous generators (Fig. 1.2, 1.4) [1].

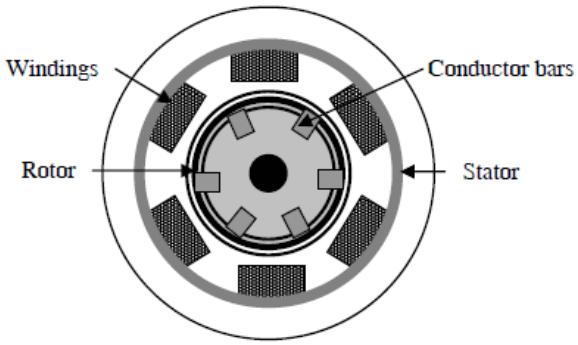

Fig. 1.1. Cross-sectional view of an induction motor [1]

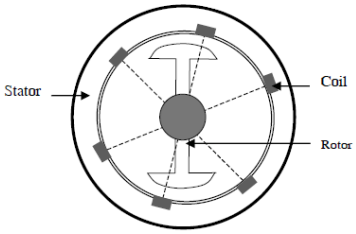

Fig. 1.2. Principle of synchronous generator [1]

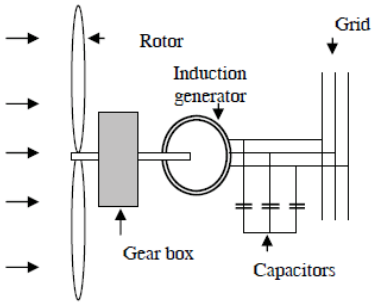

Fig. 1.3. Fixed speed wind turbine [1]

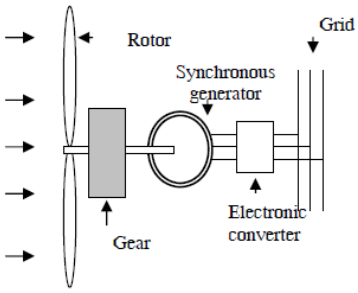

Fig. 1.4. Variable speed wind turbine with synchronous generator [1]

2. Objective

The aim of this task is to verify and understand the functioning of the aero-generator, by determining the I-V curve and the typical operational parameters, such as the short circuit current (Isc), the open-circuit voltage (Voc), as well as the maximum power (Pmax).

3. Required elements

a) required elements

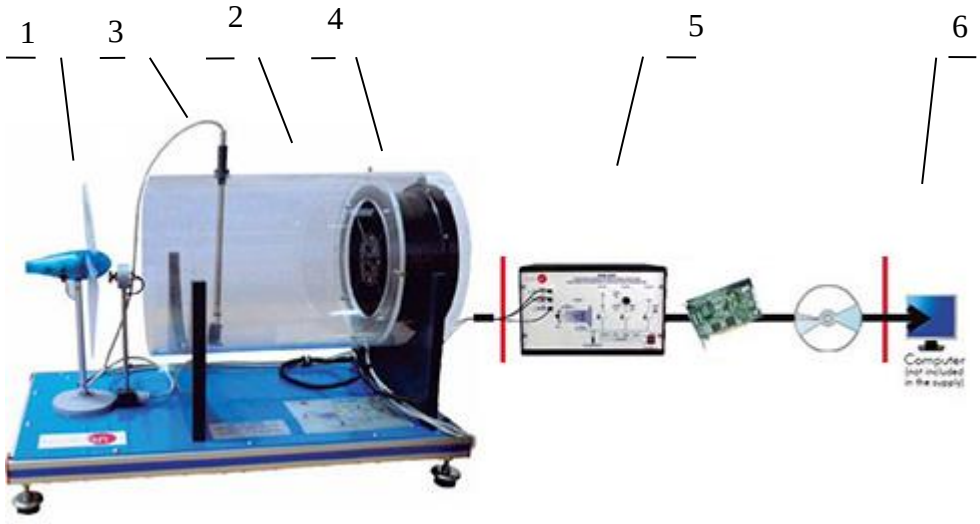

Fig. 2 Required elements: 1-fan, 2-wind tunnel, 3-anemometer, 4- rotor, 5- Control System (SCADA) INIT1, 6 – computer

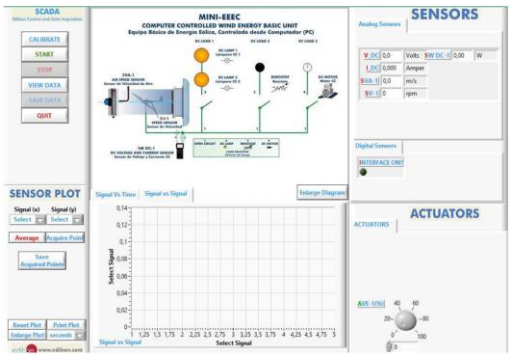

Fig. 3 Control System (SCADA)

b) Practical task (fig. 2)

Before starting the task, make sure the fan is turned off. After this, follow the steps described below:

a. Connect the single-phase power supply and put the interface in operation. Do that after verifying that every sensor is correctly connected to it.
b. Turn on the main interface.
c. Turn on the DC module.
d. Run the SCADA by EDIBON, EEEC.exe. Make sure that the PC is connected to the main interface via the SCASI cable.
e. Turn on the fan.
f. Verify that the position of the DC-load rheostat is a maximum resistance (left position).
g. Place the selector to rheostat position.
h. Disconnect the DC-lamps which are connected in parallel with the rheostat (lower switch position).
i. Move the controls AVE-1 to the maximum position, in this way we will obtain the maximum air speed. Write down the values measured by the current sensor I_DC, the voltage V_DC and the air speed SVA-1.
j. Change the position of the load rheostat approximately to the 100% of R and write down the values of the parameters obtained.
k. Repeat steps with an approximate increase or decrease of 10% of the load rheostat value until the 0% of R is reached.
l. In order to obtain the open circuit voltage of the panel, place the DC-Load selector in position 1.
m. Turn the fan off.

c) results and tables

Put all measured and calculated data into a table 1.
Draw the curve: I-V.

d) comment:

Describe how to determine the current-voltage curves of the wind turbine.

Table 1. Results of the experiment.

load	I	U
[%]	[A]	[V]
Voc		
100		
90		
80		
70		
60		
50		
40		
30		
20		
0		

Student's name:

Date:

4. Literature

1. Sathyajith Mathew: Wind Energy Fundamentals, Resource Analysis and Economics
2. www.edibon.com