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PROPOSAL FOR A PRACTICAL CLASSROOM IN THE EDUCATION OF ALTERNATIVE ENERGIES WITH A SMALL POWER WIND GENERATOR

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Abstract. *Conventional teaching methods and techniques, especially in engineering, are not effective in modern teaching. The educational process has to adapt over the years to meet the new needs of society. In recent years mankind has accumulated an enormous amount of knowledge and educational models have grown on a much smaller scale. This has created a problem in absorbing such a large amount of knowledge. From this point of view, engineering schools should prepare their students for situations that are more practical and require multidisciplinary knowledge to try to reproduce what is happening in the labor market. The present work has the objective of presenting a lesson proposal that can be developed in a practical way by students of engineering courses and technical courses. In this proposal the wind generator is presented as performing basic wind turbine tests. It is intended to make the flashing of small wind generators more understandable.*

Keywords: *Teaching methods. Engineering education. Teaching-learning process.*

1. INTRODUCTION

According to Lobo (2015), in recent years engineering and training of engineers have undergone changes. By the middle of the twentieth century, engineers were seen only as responsible for scientific knowledge. However, engineering is not just an application of science, since it uses the knowledge of something that exists to create what does not yet exist.

Nowadays, the job market requires engineers to have a broader view of the engineering and scientific foundations of the profession. They should develop skills such as: creativity, multidisciplinary, entrepreneurship, leadership development, teamwork, etc. The engineering student encounters many difficulties when entering the labor market, having to acquire practical skills that were little stimulated throughout his training, in which he focused mainly on the theoretical part of the engineering disciplines. The practical experience helps to bring the student closer to the reality of the labor market, in order to make him acquire positive parameters for his future performance in the labor market.

According to Mezzadri et al (2010), the training is linked to the student's training, so it is necessary a training that attends to all the changes that have been happening over the years in the exercise of engineering. Among these, we can mention professional competitiveness, where the fittest prevails, and for this to happen, this future-engineer must be properly prepared to meet the current demand.

The activities in which teachers from diverse disciplines come together to explore new themes, with the multidisciplinary vision desired, and introduce more practical situations for students, can better prepare them for the challenges of the labor market. In the present work, a practical lesson proposal is presented that aims to present wind

energy and small wind generator, aiming at the student to better understand its elements and its functioning, as well as make correlations of knowledge from other areas. Another objective is to observe the improvements in student learning, trying to understand the difficulties faced by the student along the course, in front of so many purely theoretical disciplines.

2. EXPERIMENTAL PROCEDURE

For the preparation of the practical class, tests were performed on a small wind turbine installed in the Laboratory of Electric Machines of the IFRN (Federal Institute of Education, Science and Technology of Rio Grande do Norte) Mossoró-RN Campus, simulating the practices to be performed. For the experiments, a fan was used to simulate the regime of winds that act on the blades of the wind turbine. The wind turbine used in this work is Air Breeze of 160 W, shown in Figure 1. This equipment can produce on average 38 kWh/month for winds with an average speed of 5.4 h/day, it has output voltage of 12 V, protection against overload through an electronic torque control, wind speed of 2.7 m/s and nominal power of 160 W for winds of 12.5 m/s.



Figure 1. Air Breeze 160 W wind turbine

For the realization of the experiments and to facilitate the understanding of its operation, to make it more didactic, an electrical system connected to the wind turbine with loads, control equipment and measuring instruments, such as inverter, load controller, and converter dc-ac, shown in Figure 2. In this lesson, the constituent parts of the wind generator, its characteristics, and function are initially presented. Then, the various control equipments, measuring instruments and loads that make up the panel of experiments with their characteristics and functions were presented. This can be part of a practical first class.

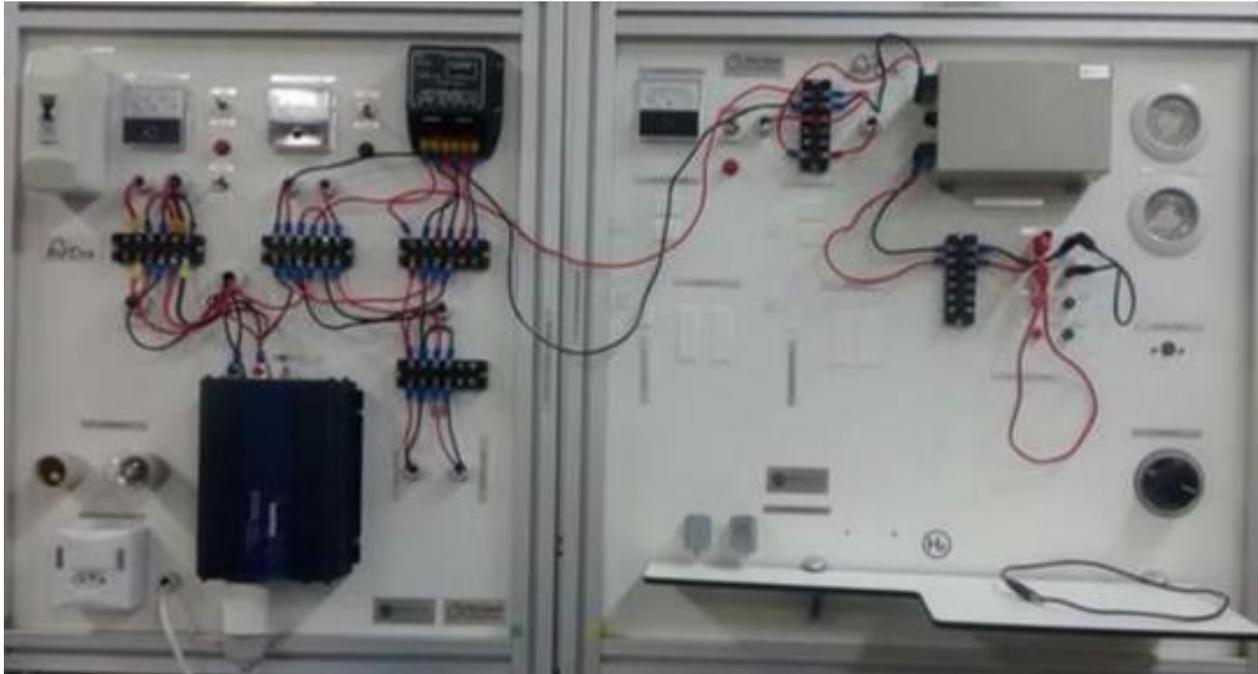


Figure 2. Electrical system connected to the aerogenerator

In another moment of the class, the aim is to identify whether the wind turbine is vertical or horizontal axis from its observation, in addition to determining if the wind generator is of the Downwind or Upwind type according to its operation by means of the fan drive, which simulates the regime of winds.

In the following tests, measurements and calculations were made to obtain: Scanning area of the wind turbine (rotor), measuring the radius of the blades with a line; Power contained in the wind, measuring the speed of the wind with the aid of the anemometer; Power available in the wind that would pass through the rotor sweep area, transverse to the air flow, disregarding the fact that the wind is not uniform throughout the section of the sweep area.

As well as verifying how the Betz Law applies to the aerogenerator, analyzing some of the calculations obtained previously, to observe its aerodynamic characteristics, such as the number of blades and their surface and to measure the speed of rotation, with the aid of a laser tachometer.

The last test carried out, to finish this lesson, is the feeding of loads with the energy generated by the wind turbine and its measurements. In this experiment it is possible to measure the current and voltage of the wind turbine by means of the measuring instruments installed in the electrical panel, as well as to calculate the power being generated, to connect some LED lamps and some loads connected to the 120 VAC socket.

3. RESULTS AND DISCUSSION

Teaching concepts, performing exercises and tests has been insufficient to prepare the engineer for the job market. When the student engages in practical activities it becomes easier to use the knowledge absorbed for problem solving. At present, it is possible to observe that in teaching engineering the method most used by teachers, in the relation between theoretical and practical classes, are the theoretical classes that present themselves in a number superior to the practices.

The class proposed in the present study, although it has not been tested with the engineering students, it is expected that the results may provide elements that will serve as a subsidy for the reformulation of other engineering teaching practices. It is expected that the elements described here and developed through the experiments, will contribute in some way to a better training of the professional.

This practical class is a proposal for improvement of the teaching-learning process, through the teaching methodology. It is hoped to be able to help in the application of mathematical, scientific, technological and instrumental knowledge to engineering. By conducting the experiments and interpreting their results. It is intended to show students some areas of influence and influence of the engineer, with a broader vision of professional vision, also instigating creativity and critical sense.

The tests performed serve as the basis for the production of practical results. From the tests and the results obtained through the measurements, calculations and analyzes, it is possible to better understand the wind generator operation, to start the exploration about the electric energy that is produced and which devices are used to monitor and control the generation of energy, as well as conditioning the energy produced so that it can be used properly in alternating current

loads. In this lesson, the teacher has the possibility of developing, together with the student, interesting results of the measurements carried out, such as the calculation of the area of the wind turbine sweep, the power contained in the wind, and the wind power density available for the wind turbine. In addition, it is possible to observe the application of physical laws in the aerogenerator, as well as to determine aerodynamic characteristics, to observe wind performance in the blades and to relate their velocity to the production of energy, or to observe the energy production by means of the power measurement generated, of the current and voltage produced, etc.

In general, the main concerns are with the use of resources that facilitate the transition from the conceptual structure of the subject to the cognitive structure of the student, with the motivation of the student in the learning process and with the students' approximation of real situations of engineer. So, reflecting on the construction of pedagogical practice, a little more focused on experimentation and not only for theory becomes a relevant subject, but still causes conflict in teaching practice in the subject of teaching.

4. CONCLUSIONS

At the conclusion of this work, it is not intended to determine what is the best teaching-pedagogical practice to teach engineering, but rather to make some timely suggestions in order to improve the professional's training.

The tests carried out at the aerogenerator and the use of this practical lesson proposal can contribute to the learning of the basic concepts that one should have in this area of renewable energies, to facilitate the assimilation, understanding and cognition of the engineering student and to bring it closer to the future professional reality who waits for him, making him benefit in his training.

When becoming an engineer, the student is faced with problems that are not always dealt with in the classroom. In this aspect, the practical class comes to help in the professional experience, since the curricular stage also plays this role in the training of the engineer, aiming the implementation of the professional performance of the student through experience and experience of the practices in the field, providing the student an approximation to the reality in which it will act.

Throughout the academic life, making the student come face to face with real situations and problems that will occur during his career makes him better prepared to solve and solve problems that will appear during the course of his professional life. Thus, experiencing more practical situations in the course, you will be better prepared and qualified for the job market.

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