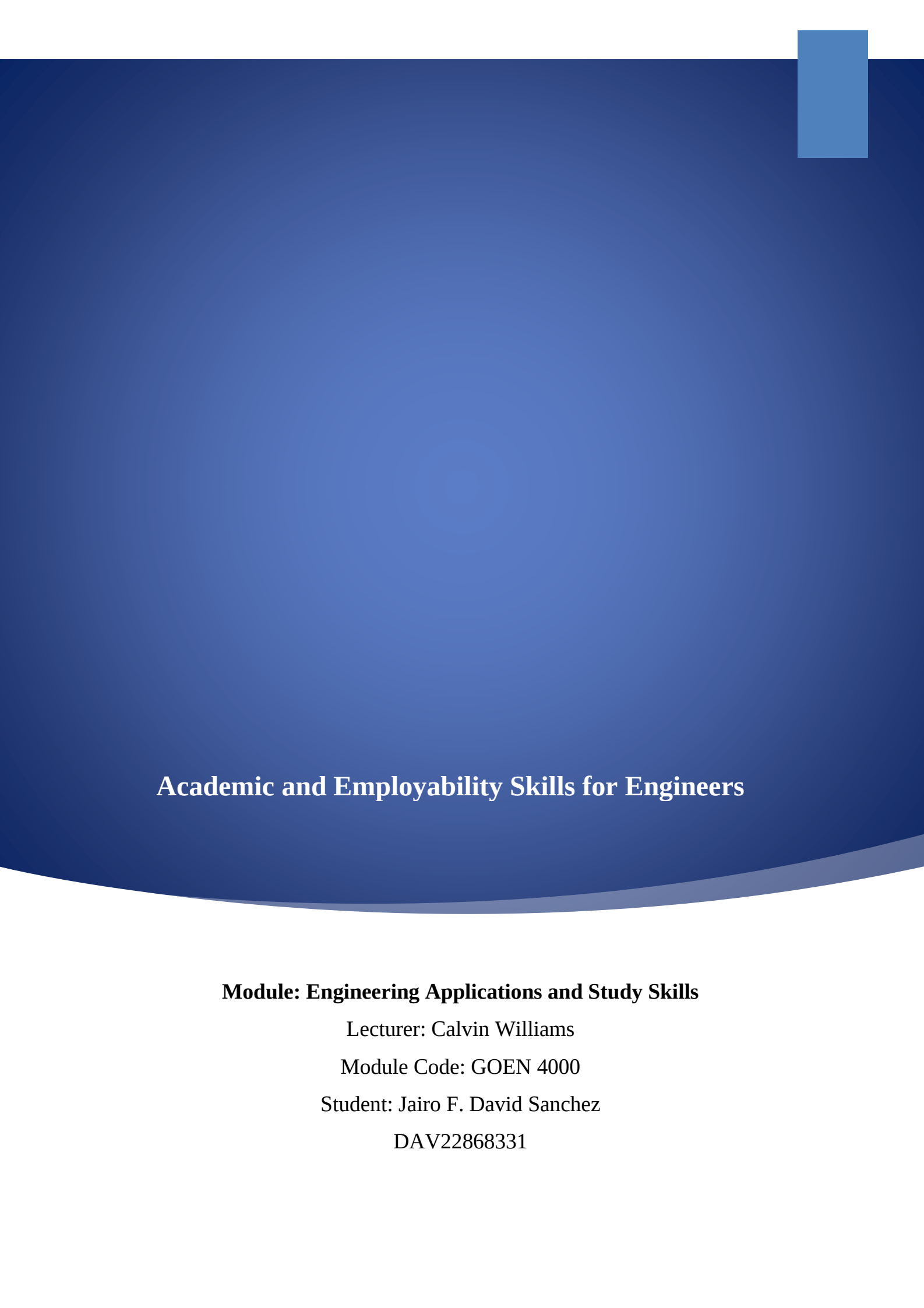




Academic and Employability Skills for Engineers

Module: Engineering Applications and Study Skills

Lecturer: Calvin Williams

Module Code: GOEN 4000

Student: Jairo F. David Sanchez

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Task 1.

Understanding Learning Styles

To assess your learning style, access <https://www.hfe.co.uk/learning-styles-questionnaire/> there you will find a simple online Questionnaire that will assess your current preferred learning. Complete the Questionnaire as accurately as possible.

Preferred Learning Styles	Your Scores
Visual	8
Aural	15
Read/Write	8
Kinaesthetic	
Multimodal	I feel comfortable reading as looking
<i>What is identified as your preferred Learning Style</i>	Aural

- **Critically evaluate the use of VARK, by examining some evidence of its value.**

Although VARK can be useful as a tool for personal reflection or for diversifying pedagogical strategies, its exclusive use or as the main foundation of educational practices is not supported by scientific evidence. It is crucial that educational institutions and teachers adopt more research-based approaches that consider the complexity of human learning.

- **Review a range of academic papers on VARK.**

According to what I've read, academic literature reflects a continuous interest in the VARK model and its application in a variety of educational contexts. Although some studies highlight its usefulness in personalising teaching strategies and improving academic performance, it's crucial to understand the criticisms and limitations associated with rigid categorisation of learning styles. A balanced approach that incorporates multiple methods and considers student diversity can lead to significant learning.

- **Having gathered information from a range of sources, express your views on VARK and its value.**

The VARK benefits pedagogical variety and learning preference awareness. Its usefulness should be questioned. The VARK should be considered as one of many methods educators can use to engage students, not a definitive paradigm for teaching.

Evidence-based teaching methods like active learning, feedback, and multimodal education work best. Although individual preferences should be considered, private attention should be paid to content and teaching methods.

Thus, VARK can supplement evidence-based teaching but not replace it. It is a beginning point for discussions regarding diversity in learning, but more comprehensive and research supported approaches are needed to improve educational outcomes.

- **With this knowledge, list some factors that influence learning.**
 - Learning is influenced by multiple factors:
 - Cognitive: Skills such as memory, attention and metacognition.
 - Emotional: Motivation, self-efficacy and anxiety management.
 - Biological: Health, age, development and neurological conditions.
 - Pedagogical: Teaching methods, feedback and strategies.
 - Social: Family support, interpersonal relationships and socio-economic context.
 - Technological: Use of digital tools and access to technology.

How can you use what you have learned to aid you in your studies?

<i>Taking information in</i>	Distance education is a challenge for educational institutions because the design of the content of their courses should pay the attention of the different learning styles of the student community. The vark model provides a quantification of students' learning styles. It evaluates four sensory modalities —visual, aural, read-write, and kinesthetic—, where everyone may have from one to four modes —with all their combinations— as learning style. The present study tried to determine the vark learning style within 66 distance education students from four educational institutions in Mexico. The results show that 46% of students surveyed used basic reader writer modality (r) as the preferred channel of learning, 37% use kinesthesia and only 5% used the visual modality as their first choice. These data suggest that it is desirable to implement multimodal virtual classrooms — learning environments that include tools that meet the different modalities vark— when designing courses for virtual education in Mexico.
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Studying & Revising

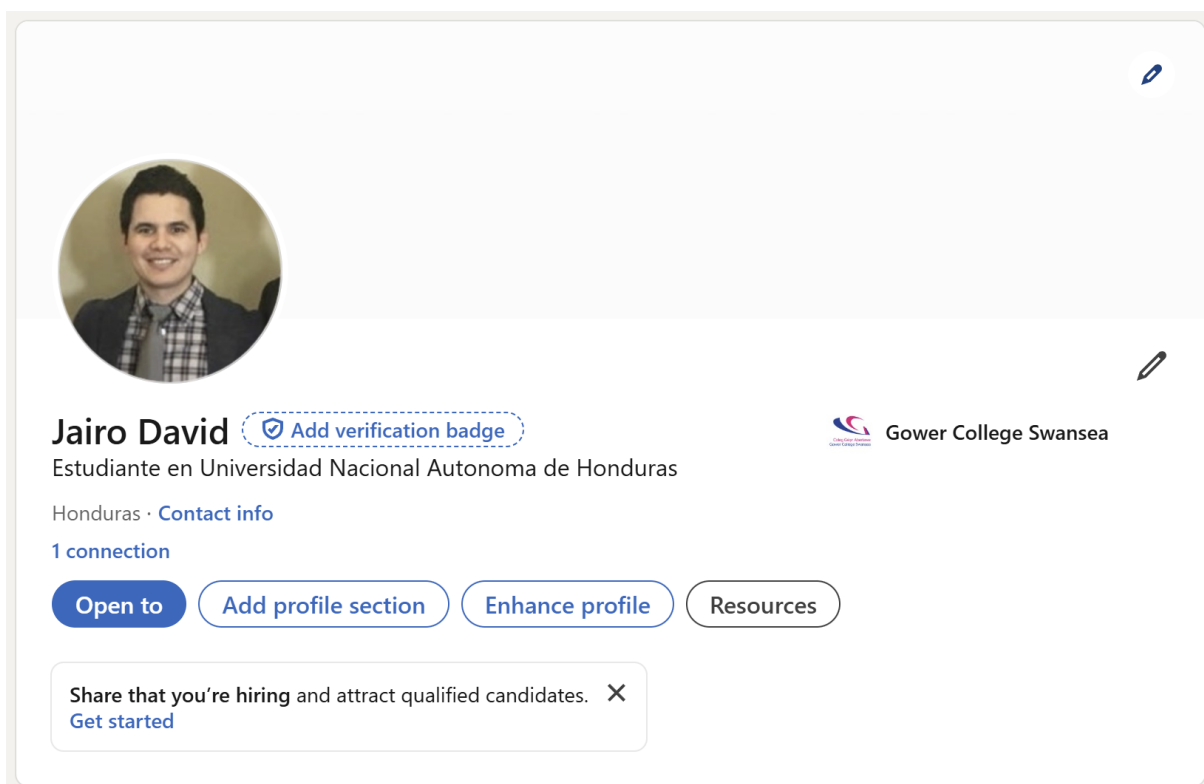
The VARK model provides a quantification of student preferences in each of the four modalities: sensory,2 everyone can present from one to four modalities with all their combinations. Thus, it can be said that visual learners prefer to learn by means of maps, tables, graphs, diagrams, flow charts, colors, photographs, figures and different spatial arrangements. The auditory, they learn by explaining new ideas to others, in discussions with teachers and students, use of stories, etc. Readers choose to list, essays, reports, textbooks, definitions, manuals, readings, web pages and notes, while kinesthetics learn through field trips, test trials and error, manipulation of artifacts, use of laboratories, recipes and solutions to problems, using their senses and making collections of samples (Hawk and Shah, 2007). In table 1 Some activities are shown that can support every learning style. As part of the kinesthetic learning style, we can also find that experience and practice as elements style badges can be purchased in a real and simulated way. Based on everything the above, the objective of the present work consisted of determining the VARK learning styles of a sample of students from distance education (n= 66), with the purpose to make proposals for multimodal virtual classrooms in the design of online courses that cater to different learning styles.

Task 2.

Skills Self-Assessment Audit – Developing your LinkedIn Profile

An important part of your development as an engineer is ability to demonstrate your skills and publicise your experience.

<https://www.michaelpage.co.uk/advice/career-advice/growing-your-career/part-one-eight-top-tips-make-your-linkedin-profile-stand>



Task 3.

As a core learning process, you are to develop a personal development plan for the **next five to ten years** of your career. Think of the following points as you develop your personal development plan.

Short and medium term	Action required	Constraints	Resources - who or what can help me?	Target dates for action
Graduating in Electrical Engineering	Complete the university or technical studies required to obtain the degree of electrical engineer.	Considering my current situation, one or several of my limitations could be time, since I am a parent and many times I will have to put my children before my studies. However, I consider that my biggest limitation could be myself because when I lived in my country of birth, although it was very hard, I managed to finish my university degree, obtaining a degree in Finance Engineering, however, now I have a new opportunity in life and I want to start from scratch and graduate as an Electrical Engineer.	First, the God who created heaven and earth whom I serve with my heart, then I can say that I am being blessed to have the opportunity to study in this institute and/or university and to have teachers who until today have supported me and really give me the opportunity to smile and enjoy my studies despite my limitations with the language. think that over the years I have had good colleagues from whom I am learning, especially in the language.	3 years.
Working as an electrical engineer	To graduate from university and not only that, to be able to train in the new areas or new systems of electrical installations that exist today, as technology is advancing by leaps and bounds and is doing so even more in the development of new ways or methods of obtaining energy, such as the generation of renewable energy. I hope to be able to do things well and to be able to give a little back to the country for all the help it has given me and my family.	I could say that the competition in the labour market is not very easy as there are a lot of skilled people and perhaps the most skilled people in the labour market are not very well trained. I have learned throughout my life that our worst threat in life is ourselves, I have learned not to give up and to see the hardest situations as a challenge in life because if I give up or run away just because I can't do something, I will be making the biggest mistake of my life because wherever I go I will always have to face a new challenge, even the same challenge I ran away from the previous time. I have always told my wife, the people who know how to do something best are not the people who overcame their problems automatically, but those who made mistakes over and over again until they were able to solve the problem. In	Since I was a child I have dreamed of being an electrical engineer and because of that dream I learned to work in electricity since I was 13 years old, I learned by watching my father and then eventually I graduated from school as a technician in electronics and industrial electricity, I think I can use my experience and seek and obtain a job in which I can demonstrate everything I learned, although my experience in the electrical area was basically in my country I am very clear that electricity has the same language anywhere in the world as its main terms will always be voltage and current. And above all respect at the moment of doing the work. I think that in summary of everything something that I believe that without a doubt would help me would be my experience in the electrical area and then I believe that I would attribute the employment exchange of the university.	4-5 years

		other words, giving up is not the solution.	Professional contacts (networks, LinkedIn, associations). Employment agencies specialising in engineering.	
UK resident	Approximately 3 years ago I arrived with my wife and son to the UK and SHAMEFULLY I had to apply for asylum, thank God in the month of November of this year my response was approved and this is the reason why I am now striving to be at this level of study, it has not been easy, to begin with I have had to learn the English language in about 1 year and a half, and I am sure that I still do not manage even 70% but I will continue to strive to be at the level that is required to be able to achieve my citizenship exams when the time comes. I will also respect the laws of this nation.	I can say that my only constraint to achieving this goal is TIME because if I continue to do things the right way and comply with the laws I will have no problem in achieving this goal.	I believe that continuing to study and work opens up opportunities for me to live in this nation and develop as a person, so that I can have the chance to enjoy my second chance at life.	7 years
Buy a house and enjoy it with my family	When you are young your mind tells you that you can eat the whole world, but as the years go by everything starts to change. When you get married and have children the real responsibilities and the real challenges start, but also the best years of a man's life begin, well this is my personal case. Now that I have the opportunity to enjoy a new life opportunity with my family I really want to be able to get my own house, logically I have to work smart (not hard) and one smart way is to study so that I can create many financial benefits and also create many satisfying memories of every opportunity and experience that comes my way in the future . I consider that this step that I am taking in my studies is and will be the basis of my future because having a stable job I will be able to generate efficiency and a stable financial credit so that I can buy a house that meets the needs that my family and I desire. I will also try to use my knowledge of finance and use all the financial leverage to optimize my economy and not waste money in the wrong way. I have always heard the saying that money does not buy happiness which is true, but it is also true that money is fundamental to give you a happy life.	Credit requirements for obtaining a mortgage. High housing costs in the current market. Job and financial stability.	Banks or institutions offering mortgages. Different ways of managing money. Create financial benefits and good contacts with which financial leverage can be created.	10 years

**Wind turbines combined with induction generators (DFIG)
Report**

Module: Engineering Applications and Study Skills

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Abstract

An essential technology in wind power generation is wind turbines combined with induction generators (DFIG). This type of generator maximises system performance by providing optimal control of active and reactive power, while operating efficiently at different wind speeds. This study illustrates the fundamentals of wind turbine operation, as well as the role of the DFIG in their operation, it means management and control, considering the analysis of their advantages and disadvantages as well as their future projections. Finally, it looks at how this technology is advancing the development of cleaner and more sustainable energy sources.

Introduction

Nowadays, renewable energy sources are essential to achieve a more sustainable and environmentally friendly energy model, in which renewable energies have become one of the most popular due to their existence and minimal environmental impact. One of the key innovations that has improved the stability and efficiency of contemporary power systems is the doubly fed induction generator (DFIG). This generator, which is used in wind turbines, allows precise control of the rotational speed of the turbine, maximising wind energy harvesting without depending on weather conditions. The DFIG is an efficient option for power generation in areas with changing weather conditions, as it can operate at different speeds while reducing energy losses and operating costs. This system has contributed to the development of more economical, durable and efficient power turbines, establishing the stability, viability and cost-effectiveness of electric power in electricity grids. Electric power has emerged as one of the most practical and sustainable ways to reduce dependence on fossil fuels. According to the most recent report of the Global Wind Energy Council (GWEC, 2023), [1] the global installed capacity of wind power exceeded 900 GW, making significant changes and contributing to reducing the effects of climate change and clean energy supply. Due to their ability to generate electricity efficiently, even in changing wind conditions, power turbines with DFIG generators have risen to the top of the power generation hierarchy. [2]

Objectives

Overall objective:

To examine the performance and efficiency of ethanolic turbines equipped with DFIG generators, considering their importance in clean energy production.

Specific Objectives:

- To understand the basic components and operating principles of wind turbines.
- To explain the operation of the double induction dielectric generator (DFIG), benefits, drawbacks and uses of DFIG

Operation of wind turbines

To generate electrical energy, wind turbines use the wind as a force and, in turn, the main components of the turbines to implement the principles of computational power [3].

Rotor: It captures the wind energy and converts it into rotational motion. There are several rotor designs, such as three-plane rotor designs (often used for their aerodynamic efficiency) and vertical axis models, which are less common but suitable for urban environments due to their ability to capture wind from any direction.

Multiplier: Increases the rotational speed of the rotor to match the needs of the generator. In some contemporary designs, variable speed generators are used, which eliminate the need for a multiplier and therefore reduce maintenance.

Generator: Transforms mechanical energy into electrical energy. Depending on the type of turbine, the most commonly used generators are induction and siphon generators. The control system ensures a stable connection to the grid and optimises the operation of the turbine. For example, it uses algorithms to maximise energy harvesting in different wind conditions and to adjust the blade angle (system pitch).

A concrete example of optimisation is the adjustment of the angular shape of the blades. When the wind speed is low, the blades are positioned to maximise energy harvesting towards the rotor by increasing the aerodynamic drag. Conversely, in high wind conditions, the system modifies the angle of the blades to reduce drag, avoiding possible structural damage and improving turbine stability.

An explanation of the Doubly Fed Induction Generator (DFIG)

The unique feature of the DFIG asynchronous generator is that both the stator and the rotor are connected to power supplies. The stator is connected directly to the mains, while the rotor is connected to a system of power converters, allowing independent control of active and reactive power. [4]

Operating principle:

It operates in a range of speeds above and below sinusoidal speed.

The converters control frequency and rotor deceleration.

The size of the converter is approximately 25-30% of the rated generator power, which reduces costs.

Converter topology and efficiency:

The converter system has two main components:

Rotor-side converter: This converter is responsible for controlling the rotor current, which in turn affects reactive power and deceleration. It makes use of an IGBT transistor source to provide operational flexibility and fast control.

Red side of the converter: Bridges the rotor to the mains, ensuring constant power transfer and reducing harmonic distortions.

The use of smaller converters (approximately one quarter of the total power) not only reduces the cost of the equipment but also reduces energy losses during conversion. This configuration allows the DFIG to maintain high overall performance even in fluctuating wind conditions. The ability to independently manage reactive and active

power also helps stabilise the grid, making the DFIG the perfect choice for integrating electrical power in grids with high penetration of renewable sources

Control and operation of the DFIG

The DFIG is controlled by a system of electronic converters that allows:

Maximum energy extraction for variable wind speeds is the objective of the speed control.

Reactive power control: Increasing the stability of the power grid.

Applying complementation strategies in response to grid outages is one way to protect against errors.

By controlling communication between the rotor and the grid, converters ensure flexible and efficient operation.

Advantages and disadvantages of DFIG in eulogetic turbines [5]:

Advantages:

Ability to operate over a wide range of wind speeds.

Independence from both reactive and active potential.

Reduced size and price of converters.

Excellent operating efficiency.

Disadvantages:

Increased control system complexity.

More expensive than standard wind turbines.

Sensitivity to grid disturbances.

Needs additional protection to prevent damage during redundancies.

Prospects and applications

Because of their efficiency and ability to adapt to the demands of the grid, DFIG turbines are widely used in green parks. For example, the Hornsea One project uses DFIG turbines, enabling it to achieve an installed capacity of 1,218 MW offshore, enough to power more than one million homes. This indicates that the use of DFIG is promoting stability and confidence in energy systems.

In the future, we foresee Developments in materials and design: Research into stronger and more habitable materials promises the development of more compact and robust generators, capable of withstanding harsh environments, such as offshore oil fields. Increased integration with smart systems: The development of smart grids would enable better energy management, encouraging the integration of renewable energy sources and reducing losses.

Energy storage systems: The use of electronic turbines together with storage systems, such as lithium-ion batteries, can increase the stability and reliability of electricity supply, especially in areas with high wind variability.

Conclusion

It is concluded that wind turbines equipped with DFIG offer an advanced solution for wind power generation. Given their ability to operate in a variety of wind conditions, as well as their advanced efficiency and control, they are an essential part of the transition to cleaner energy sources.

Considering the technical challenges posed by the complexity of the control system, sensitivity to grid outages and the need for additional protection to prevent damage

during outages, it should be noted that technology is constantly evolving, and new projects require us to keep up to date and at the forefront with new equipment, such as this generation of DFIGs.

It is expected that in the future, DFIGs will be more robust and have a user-friendly interface in their operating controls, as this will make them even more efficient and open up opportunities to prevent component failures and reduce the percentage of losses caused by network failures.

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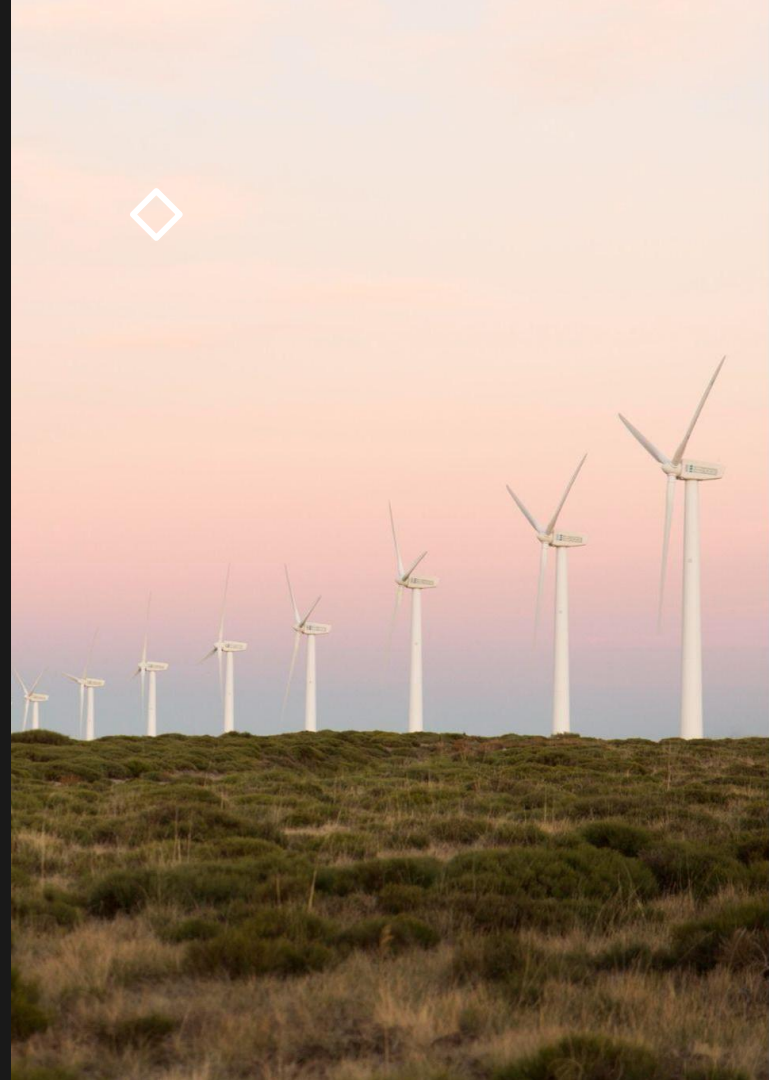
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Wind turbines combined with induction generators (DFIG)



**Renewable energy is vital for a sustainable future.
Wind power, due to its minimal environmental impact,
plays a key role.**



- **DFIG (Doubly Fed Induction Generator):**
 - Key innovation in wind turbines, allowing precise control of rotational speed and optimal energy capture.
 - Operates efficiently in varying wind conditions, reducing energy losses and costs.
- **Global Impact:**
 - Over 900 GW of installed wind power capacity (GWEC, 2023), significantly contributing to clean energy supply and climate change mitigation.



02

Operation of Wind Turbines

Key components:



Rotor:

Captures wind energy and converts it into rotational motion.

Multiplier:

Increases rotational speed to match generator requirements.

Generator:

Converts mechanical energy into electrical energy.

Control System:

Optimizes energy harvesting and adjusts blade angles.

Blade Angle Optimization:

Low Wind: Maximizes energy capture by increasing aerodynamic drag.

High wind: Reduces drag to avoid structural damage, ensuring stability



03

DFIG: Features, Advantages, and Challenges



Unique Features:

Stator directly connected to the grid; rotor connected via power converters. Allows independent control of active and reactive power. Converters manage rotor current and grid connection efficiently.



Advantages:

Operates across a wide wind speed range. Cost-effective and energy-efficient converter design (25–30% of generator power). Stabilizes grids with high renewable penetration.

Disadvantages:

Complex control system and higher cost. Sensitive to grid disturbances; requires additional protection.





Current Applications:

Widely used in wind farms, e.g., Hornsea One with 1,218 MW capacity.



Future Developments:

- ❑ **Materials & Design:** Compact, robust generators for harsh environments.
- ❑ **Smart Integration:** Enhanced energy management via smart grids.
- ❑ **Energy Storage:** Integration with systems like lithium-ion batteries for stability in variable wind conditions.



Conclusion:

DFIG turbines are advancing renewable energy, promoting sustainability, and reducing dependence on fossil fuels.

