A

PROJECT REPORT

ON

CORELESS GENERATOR

Submitted in partial fulfillment for the degree of

BACHELOR OF ENGINEERING

IN

ELECTRICAL

BY

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CERTIFICATE

This is to certify that the project entitled "**Coreless Generator**" is a bonafide work of **"Khan Faisal Habib(11EE23), Khan Mohd. Nawaz Hanif(11EE25), Shaikh Abdullah Abdul khalique(11EE37), Ansari Aasif Akhtar Hussain(11EE07)"** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering in Electrical Engineering.

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Project Approval for B.E

This project report entitled "**Coreless Generator**" by **(Khan Faisal Habib, Khan Mohd. Nawaz Hanif, Shaikh Abdullah Abdul khalique, Ansari Aasif Akhtar Hussain)** is approved for the degree of **Bachelor of Engineering** in **Electrical Engineering**

Examiners

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2. --------------------

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Khan Faisal Habib

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ABSTRACT

The project deals with the construction of a single phase Permanent Magnet Generator for Wind energy applications. Problems with the existing generators is the presence of Iron core Stators which cause iron losses comprising of Eddy current and Hysteresis losses.

Idea is to build an ironless stator which will eliminate these losses. This stator is formed with the help of a mould. Design aspects of the generator comprises of double rotor and concentrated winding. There is an inner and an outer Rotor between which lies stator. The stator is moulded and in the mould are affixed coils of the concentrated winding type.

Since the generator will be working in low rpm conditions (considering the velocity of wind), number of poles has to be high. The selection of the poles for this machine is therefore 20 on each rotor. The current is induced in the active length of the coil by Faraday's laws of Electromagnetic Induction. The coil consists of a multiple number of turns. Alternate poles N and S are produced along the rotor magnets. When the coil passes through a single set of poles a positive cycle of emf is induced in it and further when it passes through another set of poles a negative cycle is induced in it. Hence, for a completion of one cycle of emf, 4 poles are required.

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CORELESS GENERATOR

Chapter 1

Introduction

1.1 Concept

Nowadays the energy generation through alternate energy sources such as biogas, biomass, and residue from sugar factory. The energy is generated in the different forms such as heat, electricity, etc. the biogas is used for the general purpose such as cooking. The biomass and residue from sugar factory is used as fuel for thermal power plant for the generation of electricity. The sources which are mentioned above are the type of utilization of waste for power generation to regain or to use the waste for desired purpose as well as waste reduction. But we have put our effort to generate energy i.e. electricity by the air core generator .this system is more efficient then existing as it give good output from low input from water flow or air flow.

The proposed generator is a radial flux permanent magnet generator with a dual rotor topology. The stator is ironless or ‘air-cored’, hence the name. This generator is a single phase generator and is basically designed for wind energy applications.

In 1831-1832 Michael Faraday discovered that a potential difference is generated between the ends of an electrical conductor that moves perpendicular to a magnetic field. He built the first electromagnetic generator based on this effect, using a copper disc rotating between the poles of a horseshoe magnet. It produced a small direct current. We are also going to generate the electricity on pedal operated crank mechanism arrangement using the motive power of the pedal and multiple pulleys arrangement. It is based on the principle that when a current carrying conductor coil is rotated in the permanent magnetic field, the e.m.f. is generated.

It is important to understand that the generator creates an electric current, but does not create electric charge, which is already present in the conductive wire of its windings. It is somewhat analogous to a water pump, which creates a flow of water but does not create the water itself.

Other types of electrical generator exist, based on other electrical phenomena such as piezoelectricity, and magnetohydrodynamics. The construction of a dynamo is similar to that of an electric motor, and all common types of dynamos could work as motors. Also, all common types of electric motors could work as generators.

The Generator rotor is turned by a device termed a Prime mover, often a Petrol engine, Steam turbine, Water turbine or Gas turbine coupled to the rotor shaft.

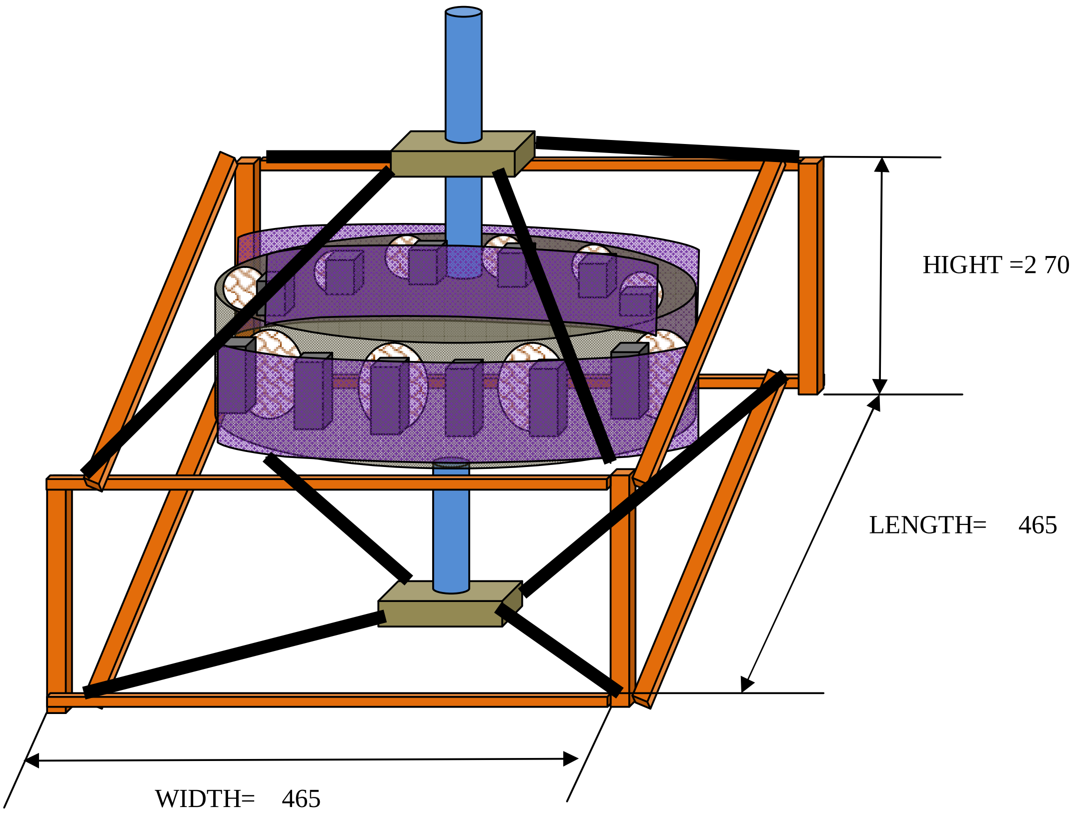
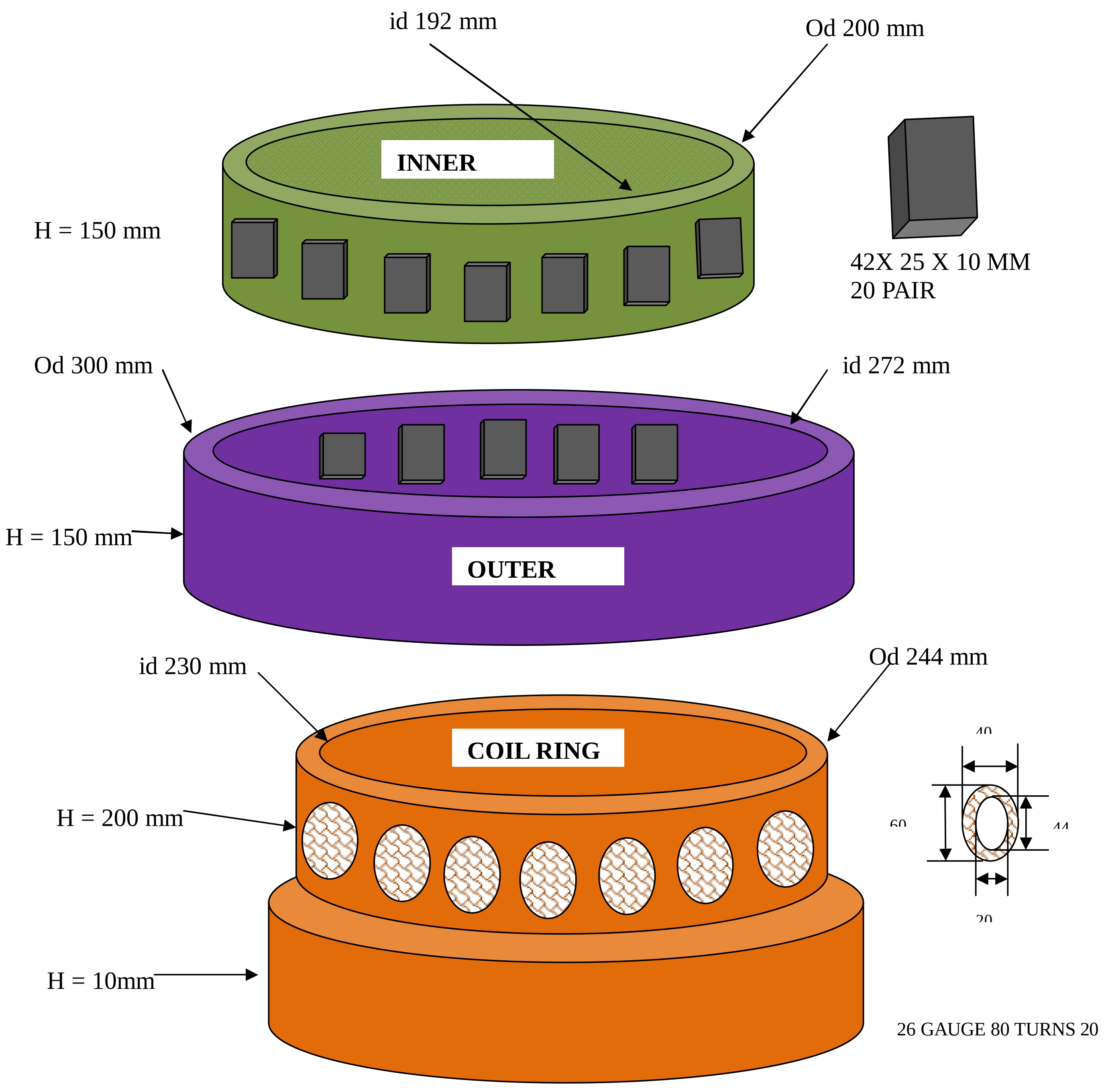


Figure 1.1 Assembly Diragam

CORELESS GENERATOR



Chapter 2

Literature Survey

2.1 Concentrating Magnetic Energy

The magnetic field is manipulated to our advantage, when making permanent magnet alternators. By concentrating the magnetic flux between two opposite magnet poles, and capturing the flux in iron plates that would otherwise be wasted, we direct as much energy as we can through the gap between the faces. The final product usually looks like this.

This set of rotors features round magnets. This is common on smaller axial-flux alternators, but as they get larger, it is often more practical to use rectangular magnets, which are available in larger sizes, and the wire coils are more compact. It is important that the rotors be made of steel or iron, so that the magnetic flux is conducted by them. The magnets are arranged in a N-S-N-S pattern around the circumference of the rotors. Opposite poles face each other. If you trace the lines of flux, they travel from one magnet face, straight to the magnet face opposite, then travel through the steel rotor plate to the next magnet, and back across the gap. Coils of wire in the gap capture the magnetic energy in those field lines.

2.2 Harnessing The Magnetic Energy

Now we come to the humble coil of wire. It doesn't do much on its own, but in the presence of magnetic fields, interesting things happen. A single loop of wire encloses a certain amount of area. The field passing through this area is a "magnetic flux". It is measured in Webers. Not much happens when the surrounding magnetic field is sitting still, but when you put the system in motion, a voltage potential is produced. The more rapidly the magnetic field changes(either greater or lesser), the more voltage is created. It doesn’t actually matter how the field is changed for the phenomenon to occur. You may have magnets that get closer together, that oscillate back and forth, flip over and over, or perhaps you don’t move the magnets at all, and instead flip the coil back and forth. In our machine, coils of wire are held steady, while the magnets spin past on the rotors. Because the magnets were arranged N-S-N-S, the direction of the field flips each time a magnet goes by. Each coil sees a flipped magnetic field, and pulse of electricity is produced.

When the field flips back, a pulse of opposite voltage is created. This coil is now producing alternating voltage. Here is a set of 9 coils that were wound for a Permanent Magnet Alternator. They are all the same size, and have the same number of turns each. Wire comes in a variety of sizes. The diameter (or “gauge”) of the wire determines the maximum amount of current it can carry. Heavier wire can carry more current than thinner wire. The builder selects a wire size that allows the current required for his design, but no bigger.

If a single loop of wire captures a certain amount of voltage in a changing magnetic field, then more of those loops will capture more voltage. The builder wants many turns of wire to capture as much as possible. This objective conflicts with the objective of allowing more current, because heavier wire takes more space. Less turns of heavy wire, or more turns of thin wire. A balance is sought by the builder to meet his needs. Experienced builders know off-hand how to strike the right balance. It is more of a mystery to the new recruit. Hopefully the diagrams at the end of this document will help.

Chapter 3

Working of The Generator

The inner and the outer rotor are attached to the same shaft. The project will be a hand generator, so a handle will be the prime mover. The prime mover rotates the inner and the outer rotor. Alternating poles in double rows are present on the rotor and the stator is in between the rotor. As a result of the resulting motion between the conductors and the magnetic field an emf is generated in the winding according to the Faraday’s laws. The terminals from each coil in the generator can be brought out either to form a series or a parallel connection. Hence the emf produced by the generator is the resultant of the series or the parallel connection as per the required voltage. The waveform of the flux density is sinusoidal in nature.

3.1 Working Principle

The underlying operating principal of these generators can be found in Faraday's law which, in its most basic form, states that an electrical potential difference is generated between the ends of an electrical conductor that moves perpendicularly through a magnetic field. In this experiment, Faraday takes a magnet and a coil and connects a galvanometer across the coil. At starting, the magnet is at rest, so there is no deflection in the galvanometer i.e needle of galvanometer is at the center or zero position. When the magnet is moved towards the coil, the needle of galvanometer deflects in one direction. When the magnet is held stationary, at that position, the needle of galvanometer returns back to zero position. Now when the magnet is moved away from the coil, there is some deflection in the needle but in opposite direction and again when the magnet becomes stationary, at that point with respect to coil, the needle of the galvanometer returns back to the zero position. Similarly, if magnet is held stationary and the coil is moved away and towards the magnet, the galvanometer shows deflection in similar manner. It is also seen that, the faster the change in the magnetic field, the greater will be the induced emf or voltage in the coil. More specifically, that the electromotive force (EMF) that is induced in any closed circuit is equal to the time rate of change of the magnetic flux through the circuit.

Consider a magnet approaching towards a coil. Here we consider two instants at time T_1 and time T_2.

Flux linkage with the coil at time, $T_1 = N\Phi_1$ Wb

Flux linkage with the coil at time, $T_2 = N\Phi_2$ Wb

Change in flux linkage = $N(\Phi_2 - \Phi_1)$

Let this change in flux linkage be, $\Phi = \Phi_2 - \Phi_1$

So, the Change in flux linkage = $N\Phi$

Now the rate of change of flux linkage = $N\Phi / t$

Take derivative on right hand side we will get

The rate of change of flux linkage = $Nd\Phi/dt$

But according to Faraday's law of electromagnetic induction, the rate of change of flux linkage is equal to induced emf.

$$\boxed{E = N\frac{d\phi}{dt}}$$

Lenz's law states that when an emf is generated by a change in magnetic flux according to Faraday's Law, the polarity of the induced emf is such, that it produces an current that's magnetic field opposes the change which produces it. The negative sign used in Faraday's law of electromagnetic induction, indicates that the induced emf (ε) and the change in magnetic flux ($\delta\Phi_B$) have opposite signs. Considering Lenz's Law.

$$\boxed{E = -N\frac{d\phi}{dt}}$$

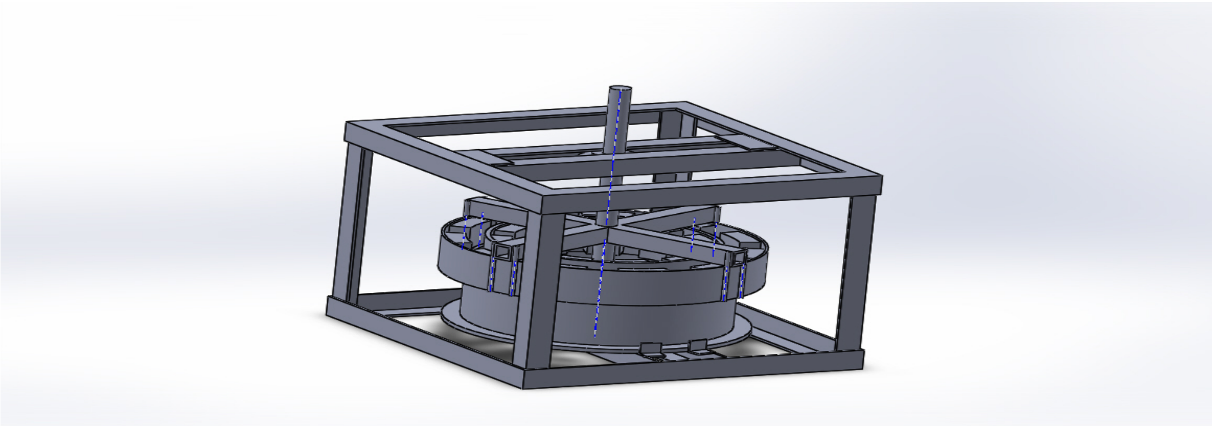


Figure. 3.1 Assembly design of the coreless Generator

Reason for opposing, cause of currents according to Lenz’s Law-

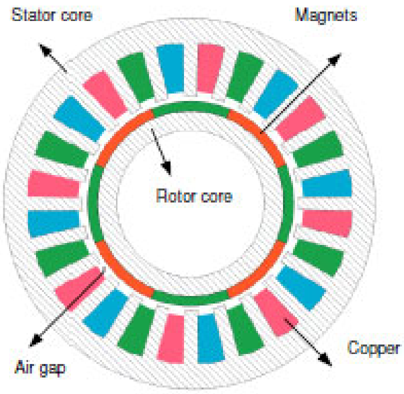
Lenz's law obeys the law of conservation of energy and if the direction of the magnetic field that creates the current and the magnetic field of the current in a conductor are in same direction, then these two magnetic fields would add up and produce the current of twice the magnitude and this would in turn create more magnetic field, which will cause more current and this process continuing on and on leads to violation of the law of conservation of energy. If the induced current creates a magnetic field which is equal and opposite to the direction of magnetic field that creates it, then only it can resist the change in the magnetic field in the area, which is in accordance to the Newton's third law of motion.

Chapter 4

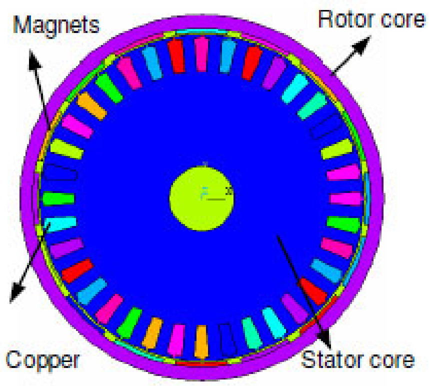
The Generator Components

4.1 Rotor

The rotor of the RFPM generator consists of two cylindrical steel yokes located concentrically one inside the other. The reason for both an inner and an outer yoke is the double row of permanent magnet (PM) material necessary to maintain the required magnetic flux density in the air-gap located between them. The large effective air-gap present in an air-cored generator possesses a much lower permeability than an iron-cored generator does. To maintain the same flux density levels in the air-gap more PM material is needed. The two steel cylindrical rotors provide a rigid steel construction, which maintains the air-gap length as well as supplies a return path for the PM's magnetic flux. Unlike in iron-cored generators, in an RFPM air-cored machine the flux distribution inside the steel rotor yokes remains static during operation. For this reason the iron losses in the rotors become negligible



Inner rotor



Outer rotor

Permanent magnet placement and shape:

The RFPM generator yokes have circumferential arrays of alternating polarity permanent magnets. The magnets are equally spaced on each yoke’s periphery.

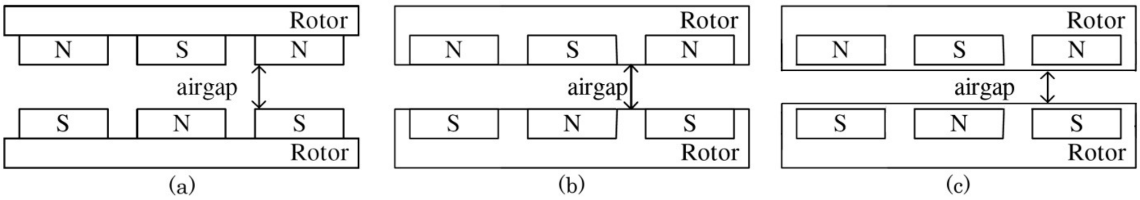


Figure 4.2: (a) Surface mounted, (b) partially embedded and (c) and fully embedded.

Inner and outer magnets are placed opposite to each other to form pole pairs. A pole pair is Magnetised in the same direction. The permanent magnets can be placed in one of three ways. They are fully embedded, partially embedded or surface-mounted. These three configurations are depicted in Fig. 4.1. A major advantage of the surface-mounted magnets is that the steel yokes do not have to possess machined slots as in the case of embedded magnets. The absence of slots allows machining costs to drop, which makes the generator more economical. Another advantage is that the surface mounted magnets act as a fan which creates a natural wind cooling effect inside the machine. The rated operating speed of the direct drive RFPM generator is relatively low and centrifugal forces present on the magnets are small. This means that the magnets can be glued onto the yokes. If the speed of such a machine increases other means of fastening, like through magnet screws, should be considered .The RFPM generator discussed in this study makes use of the surface-mounted topology. This is primarily due to the large air-gap present in air-cored machines, which causes high amounts of magnet leakage flux to occur if the magnets are embedded within the steel.

This leakage flux occurs between the magnets and iron yoke and is discussed later in the chapter. Both surfaces on which the magnets are placed are arc shaped due to the circular yokes. This means that the shape of each magnet also needs to be curved and to be radially magnetised.

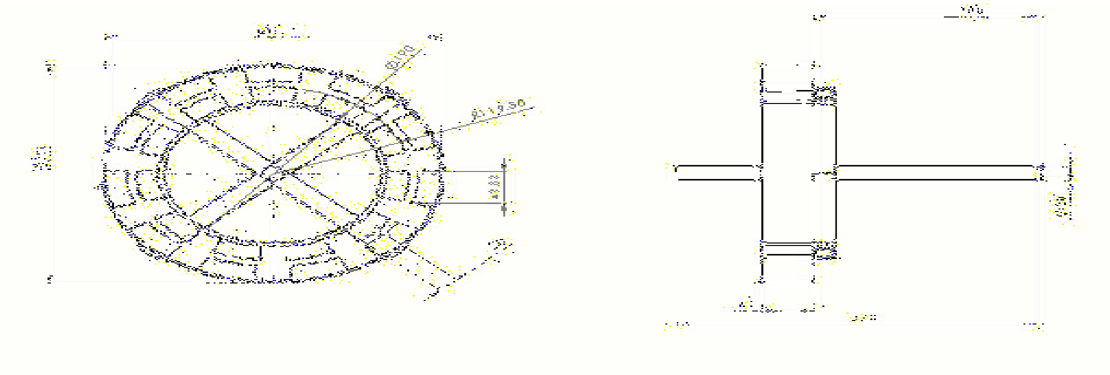


Figure 4.3 Design of Rotor

4.2 Stator

Unlike the rotor, the stator of the RFPM air-cored generator is a non-ferrous component. Whereas a conventional iron-cored generator has punched iron laminations in the stator around which the stator coils are wound, an air-cored generator has air (or another non-magnetic material). This type of stator creates a large effective air-gap between the rotor magnets, which causes low armature magnetic flux in this region. The low armature magnetic flux of the stator is responsible for the low inductance values of these coreless machines. The round cylinder stator piece is located between the two rotor disks. Conductors are located circumferentially around the air-gap and are kept in place with epoxy resin to form the stator. The stator is manufactured by casting the piece with the help of a mould.

Figure 4.4 Stator

4.3 Coil

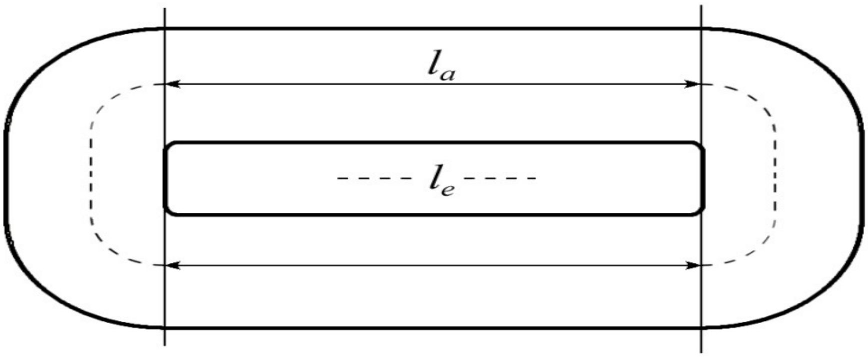


Figure 4.5 Coil profile in the air core generator

la= active length

le= end winding length

therefore, total length is 2la+le

4.4 Windings

Recent studies on RFPM machine winding layouts have found the benefit of incorporating concentrated windings in these machines. The main reasons for considering this winding topology is the potential reduction in manufacturing cost, while simultaneously producing the same amount of torque as that of an overlapping winding in three phase. Using concentrated coils allows for a simpler coil construction which could ultimately lead to automated manufacturing of the stator and smaller end-turn lengths of the coils implying less copper being used. Overlapping windings are also very difficult to realise in these machines (three phase) because of their double-sided rotor topology.

Figure 4.6 Concentrated winding

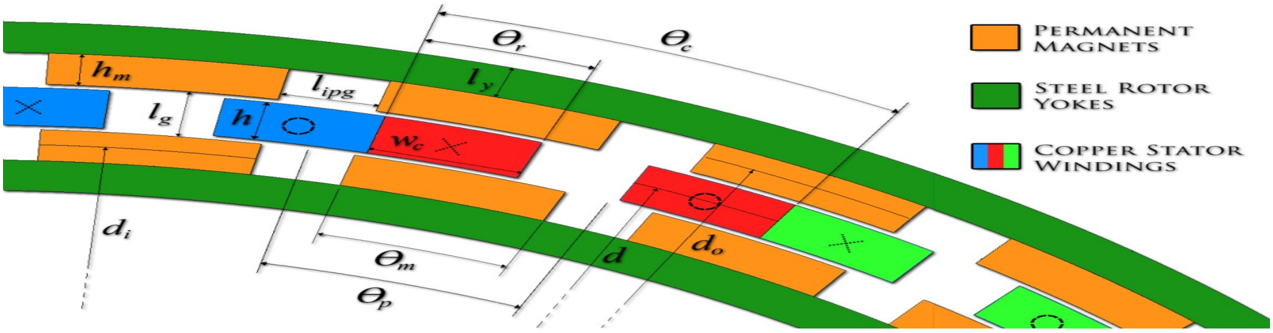


Figure 4.7 Cross section

Chapter 5

Wind Energy

Wind energy is available free of cost but to harness it a number of factors have to be considered. For this reason we must know how the kinetic energy of the wind is converted into electrical energy. The reason for the kinetic energy present in the wind is due to wind consisting of moving air. To have kinetic energy a fluid medium has to possess mass and momentum. Since atmospheric air is a gas made up largely of nitrogen and oxygen it possesses a low density. The average air density at sea level is 1.225 kg/m3. This is about 816 times lower than the density of water. Even though air has a low density, it still has mass and possesses kinetic energy. The kinetic energy present in the wind can be calculated by

$$E = \frac{1}{2}\rho V v^3$$

Where E is the kinetic energy, ρ is the density of air, V is the volume of the wind interacting with the turbine and v is the velocity of the wind. Then the power obtained is

$$P = \frac{1}{2}\rho A_s v^3$$

Where A_s is the swept area of the blades.

Since air has to pass through the swept area of the blades, some of the kinetic energy should be retained behind the blades. This means that only the fraction of the total available power can be harnessed by the wind turbines. The power equation will be

$$P = \frac{1}{2}C_p \rho A_s v^3$$

where C_p is the turbine power coefficient or the turbine efficiency. Turbine efficiency should not be confused with the generator efficiency. The turbine efficiency is the ratio of the mechanical power delivered to the turbine blades to the kinetic energy in the incoming wind. The maximum value of C_p is 0.5926. The power coefficient is a function of the turbine's tip speed ratio.

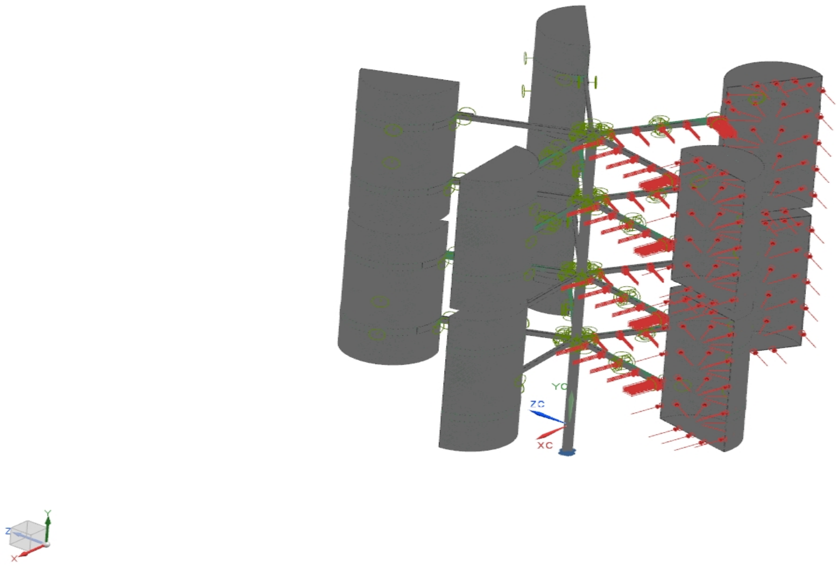


Figure 5.1 Model of Wind Turbine

Turbine blades rotating at a low speed will allow the wind to pass through the gaps between the blades undisturbed, while high speed rotation will act as a barrier to the incoming wind [24]. In both of these cases the energy in the wind is not optimally resourced. By varying the tip speed of the blades with the incoming wind speed, an optimum Cp value can be realised. The tip speed ratio, λs, defined as the ratio of blade tip speed to the free stream wind speed on the windward side of the turbine, is given by

$$\lambda = \frac{r_b w_m}{v}$$

Where r_b is the turbine blade radius and w_m is the mechanical angular velocity of the wind turbine. While designing a wind turbine a designer has a control over the coefficient of turbine power and the blade swept area but a little control over the air density and the wind speed.

5.1 Electrical Generators in Wind Turbines

An electrical generator in its most simple form comprises a rotor and a stator. The rotor is a rotating part of the generator and the stator is a stationary part. One particular class of electrical generator makes use of permanent magnets (PMs), mounted on either the rotor or the stator, to establish a magnetic field (flux) in the generator. These generators are referred to as permanent magnet generators. Coils of conductive material (normally copper wire) are secured to either the stator or the rotor of the generator and as the rotor rotates with respect to the stator, the movement of the magnetic field relative to the conductive windings induces a current in the windings. The current so induced may then be used to power electrical appliances or to store electrical charge by, for example, charging batteries. Electrical generators are currently used in a number of applications, but are becoming increasingly popular for use in wind generators, mainly because electricity generated by means of wind is considered to be a clean source of energy. Wind generators convert the kinetic energy of wind into mechanical (mostly rotational) energy which is then converted into useful electrical energy. A basic wind generator includes a number of aerofoil shaped blades, mounted on an axle for rotation in wind. The rotation is imparted to the rotor of an electrical generator which, in turn, generates electricity.

5.2 Disadvantages of Conventional Wind Generators

Conventional wind generators suffer from a number of disadvantages. One such disadvantage is that the majority of such generators utilize iron core stators. Apart from the high cost associated with iron cores, they are also heavy and require additional resources and support to install, stabilize and maintain. Iron core stators also suffer from cogging torque, which is the torque resulting from the interaction between the permanent magnets of the rotor and the stator slots of a PM machine. It is also known as detent or "no- current" torque. Cogging torque is an undesirable component for the operation of iron-core electric generators. It is especially prominent at lower speeds and manifests itself in stuttered rotation. A further disadvantage of conventional wind generators is the cost associated with their repair and maintenance. In particular, where windings on either the rotor or stator become worn or defective, highly skilled technicians are required to conduct repair or maintenance. The weight and unwieldiness of conventional iron-core stators also often require the use of machinery or teams of technicians to conduct even routine maintenance.

5.3 Radial flux permanent magnet wind generator

In large wind turbine applications the system usually consists of a wind turbine connected to a gearbox, which in turn is connected to an electric generator. Recently however, wind turbine developers have seen the advantages of omitting the gearbox and coupling the electric generator directly to the wind turbine . The reason for this direct drive wind turbine is to minimise losses related to gearboxes. Since this topology eliminates the need for a gearbox, it also effectively eliminates the negative aspects associated with gearboxes such as the need for gearbox repairs, gearbox maintenance and complex installation procedures. Furthermore gearboxes are heavy and expensive. In this study a direct drive system is implemented. A radial-flux permanent magnet (RFPM) direct drive generator derives its name from the radial orientation of its magnetic flux path, its permanent magnet excitation (PM) and its direct driven topology. In a radial flux machine, the magnetic flux lies perpendicular to the axis of rotation. The radial flux is produced by the permanent magnets present in this type of machine. These magnets replace the electromagnets produced by excited coils in other machines. An alternative topology to the radial-flux machine is known as an axial-flux machine. In this case the magnetic flux path lies axially along the machine, parallel to the axis of rotation. In both of these topologies the rotors are made up of two interconnected steel disks which act as a housing and flux return path for the surface-mounted permanent magnets. An air-cored (iron-less) stator is located between the two opposing rotors. The stator consists of copper conductors embedded in a hardened epoxy resin. In this study the focus is on a RFPM generator type.

5.4 Advantages of permanent magnets

Permanent magnet excited machines have a series of economic and technical advantages over the electrically excited type. Some of these advantages can be summarized as follows:

a) No additional power supply for the magnet field excitation.

b) Improvement in the efficiency and thermal characteristics of the motor due to absence of the field losses.

c) Higher reliability due to absence of mechanical components e.g. slip rings.

Higher power to weight ratio.

Permanent-magnet machines allow a great deal of flexibility in their geometry. Based on the direction of flux penetration, permanent magnet machines can be classified as: radial flux, Axial-flux and transversal-flux machines.

5.5 Advantages of a radial flux machine

The permanent magnets of radial-flux machines are radially oriented. Radial-flux Permanent-magnet machines can be divided mainly into two types, surface-magnet and Buried-magnet machines. The simple way of constructing the rotor with high number of poles is by gluing the permanent magnets on the rotor surface of the machine.

Chapter 6

Material selection

The proper selection of material for the different part of a machine is the main objective in the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors:

a) Availability of the materials.
b) Suitability of materials for the working condition in service.
c) The cost of materials.
d) Physical and chemical properties of material.
e) Mechanical properties of material.

- The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows:
- Strength : It is the ability of a material to resist the externally applied forces
- Stress: Without breaking or yielding. The internal resistance offered by a part to an externally applied force is called stress.
- Stiffness: It is the ability of material to resist deformation under stresses. The modules of elasticity of the measure of stiffness.
- Elasticity: It is the property of a material to regain its original shape after deformation when the external forces are removed. This property is desirable for material used in tools and machines. It may be noted that steel is more elastic than rubber.
- Plasticity: It is the property of a material, which retain the deformation produced under

- load permanently. This property of material is necessary for forging, in stamping images on coins and in ornamental work.
- Ductility: It is the property of a material enabling it to be drawn into wire with the application of a tensile force. A ductile material must be both strong and plastic. The ductility is usually measured by the terms, percentage elongation and percent reduction in area. The ductile materials commonly used in engineering practice are mild steel, copper, aluminum, nickel, zinc, tin and lead.
- Brittleness: It is the property of material opposite to ductile. It is the property of breaking of a material with little permanent distortion. Brittle materials when subjected to tensile loads snap off without giving any sensible elongation. Cast iron is a brittle material.
- Malleability: It is a special case of ductility, which permits material to be rolled or hammered into thin sheets, a malleable material should be plastic but it is not essential to be so strong. The malleable materials commonly used in engineering practice are lead, soft steel, wrought iron, copper and aluminum.
- Toughness: It is the property of a material to resist the fracture due to high impact loads like hammer blows. The toughness of the material decreases when it is heated. It is measured by the amount of absorbed after being stressed up to the point of fracture. This property is desirable in parts subjected to shock an impact loads.
- Resilience: It is the property of a material to absorb energy and to resist rock and impact loads. It is measured by amount of energy absorbed per unit volume within elastic limit. This property is essential for spring material.
- Creep: When a part is subjected to a constant stress at high temperature for long period of time, it will undergo a slow and permanent deformation called creep. This property is considered in designing internal combustion engines, boilers and turbines.
- Hardness: It is a very important property of the metals and has a wide variety of meanings.
- It embraces many different properties such as resistance to wear scratching, deformation and mach inability etc. It also means the ability of the metal to cut another metal. The hardness is usually expressed in numbers, which are dependent on the method of making the test.
- The hardness of a metal may be determined by the following test.

a) Brinell hardness test
b) Rockwell hardness test
c) Vickers hardness (also called diamond pyramid) test and
d) Share scaleroscope.

The science of the metal is a specialized and although it overflows in to realms of knowledge it tends to shut away from the general reader. The knowledge of materials and their properties is of great significance for a design engineer. The machine elements should be made of such a material which has properties suitable for the conditions of operations. In addition to this a design engineer must be familiar with the manufacturing processes and the heat treatments have on the properties of the materials. In designing the various part of the machine it is necessary to know how the material will function in service. For this certain characteristics or mechanical properties mostly used in mechanical engineering practice are commonly determined from standard tensile tests. In engineering practice, the machine parts are subjected to various forces, which may be due to either one or more of the following.

- Energy transmitted
- Weight of machine
- Frictional resistance
- Inertia of reciprocating parts
- Change of temperature
- Lack of balance of moving parts

The selection of the materials depends upon the various types of stresses that are set up during operation. The material selected should with stand it. Another criteria for selection of metal depend upon the type of load because a machine part resist load more easily than a live load and live load more easily than a shock load.

Selection of the material depends upon factor of safety, which in turn depends upon the following factors.

- Reliabilities of properties
- Reliability of applied load
- The certainty as to exact mode of failure

- The extent of simplifying assumptions
- The extent of localized
- The extent of initial stresses set up during manufacturing
- The extent loss of life if failure occurs
- The extent of loss of property if failure occurs

For Base plate, motor support, sleeve and shaft Material used is Mild steel

Reasons:

- Mild steel is readily available in market
- It is economical to use
- It is available in standard sizes
- It has good mechanical properties i.e. it is easily machinable
- It has moderate factor of safety, because factor of safety results in unnecessary wastage of material and heavy selection. Low factor of safety results in unnecessary risk of failure
- It has high tensile strength
- Low co-efficient of thermal expansion

6.1 Properties Of Mild Steel

M.S. has a carbon content from 0.15% to 0.30%. They are easily wieldable thus can be hardened only. They are similar to wrought iron in properties. Both ultimate tensile and compressive strength of these steel increases with increasing carbon content. They can be easily gas welded or electric or arc welded. With increase in the carbon percentage weld ability decreases. Mild steel serve the purpose and was hence was selected because of the above purpose

Bright material.

It is a machine drawned. The main basic difference between mild steel and bright metal is that mild steel plates and bars are forged in the forging machine by means is hot forged. But the materials are drawn from the dies in the plastic state. Therefore the material has good surface finish than mild steel and has no carbon deposits on its surface for extrusion and formation of engineering materials thus giving them a good surface finish and though retaining their metallic properties.

Chapter 7

Cost Estimation

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involved in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

7.1 Purpose Of Cost Estimating

1. To determine the selling price of a product for a quotation or contract so as to ensure a reasonable profit to the company.
2. Check the quotation supplied by vendors.
3. Determine the most economical process or material to manufacture the product.
4. To determine standards of production performance that may be used to control the cost.

7.2 Basically The Budget Estimation Is Of Two Types

1. material cost
2. Machining cost

7.2.1 Material Cost Estimation

Material cost estimation gives the total amount required to collect the raw material which has to be processed or fabricated to desired size and functioning of the components.

7.2.2 Machining Cost Estimation

This cost estimation is an attempt to forecast the total expenses that may include to manufacture apart from material cost. Cost estimation of manufactured parts can be considered as judgment on and after careful consideration which includes labour, material.

7.3 Procedure For Calculation Of Material Cost

The general procedure for calculation of material cost estimation is

1. After designing a project a bill of material is prepared which is divided into two categories.
    a. Fabricated components
    b. Standard purchased components
2. The rates of all standard items are taken and added up.
3. Cost of raw material purchased taken and added up.

7.4 Labour cost:

It is the cost of remuneration (wages, salaries, commission, bonus etc.) of the employees of a concern or enterprise.

Labour cost is classifies as

1 Direct labour cost

2 Indirect labour cost

7.4.1 Direct labour cost

The direct labour cost is the cost of labour that can be identified directly with the manufacture of the product and allocated to cost centers or cost units. The direct labour is one who counters the direct material into saleable product; the wages etc. of such employees constitute direct labour cost. Direct labour cost may be apportioned to the unit cost of job or either on the basis of time spend by a worker on the job or as a price for some physical measurement of product.

Indirect labour cost

It is that labour cost which can not be allocated but which can be apportioned to or absorbed by cost centers or cost units. This is the cost of labour that doesn’t alters the construction, confirmation, composition or condition of direct material but is necessary for the progressive movement and handling of product to the point of dispatch e.g. maintenance, men, helpers, machine setters, supervisors and foremen etc.

The total labour cost is calculated on the basis of wages paid to the labour for 8 hours per day.

Cost estimation is done as under

Cost of project = (A) material cost + (B) Machining cost + (C) labour cost

7.5 Raw Material & Standard material Cost

Table 1: cost estimation

Sr no.	Part name	Material	Qty	Cost
1	Frame	MS	20kg	1200.00
2	Magnet	Ferrite	40 nos	4000.00
3	Cu Coil	Cu	10 nos	2400.00
4	Coil Ring	MS	1 nos	700.00
5	Magnet Ring	MS	2 nos	1400.00
6	Bearing	STD	2nos	600.00
7	Shaft	En8	1 nos	450.00
8	Diode	STD	20 nos	150.00
9	Handel	MS	1 nos	250.00
10	Led Light	STD	1 nos	85.00
11	Nut Bolt Washer m 10	MS	8 nos	75.00
12	Welding Rod	-	1 50 nos	150.00
13	Colour	**-**	2 lit	100.00
14	Wind Blade	PVC	3 nos	1500.00
			Total	13060.00

Chapter 8

Manufacturing Process

The following are the various manufacturing process used in mechanical engineering.

8.1 Primary Shaping Process

The process used for the preliminary shaping of the machine component is known as primary shaping process.

8.2 Machine Process

The process used for giving final shape to the machine component, according to planned dimensions is known as machining process. The common operation drilling, boring etc.

8.3 Surface Finishing Process

The process used to provide a good shape surface finish for the machine components are known as surface finishing processes. The common operation used for the process are polishing, buffing, lapping etc.

8.4 Joining Process

The process used for joining machine components are known as joining process. The common operation used for this process are soldering, brazing, welding etc.

8.5 Process Affecting Change In Properties

These are intended to import specific properties to material e.g. heat treatment, hot working, cold rolling etc.

8.6 Welded Joints

8.6.1 Definition

A welded joint is a permanent joint, which is obtained by the fusion of the edges of the two parts, to be joined together, with or without the application of pressure and a filler material.

Welding is intensively used in fabrication as an alternative method for casting or forging and as a replacement for bolted and reverted joints. It is also used as a repair medium.

Figure 8.1 Welding

8.6.2 Advantages

1) The welded structures are usually lighter than riveted structures.

2) The welded joints provide maximum efficiency which to impossible innervated joints.

3) Alteration and addition can be easily made.

4) As the welded structure is smooth in appearance, it is good looking.

5) In welded structures, tension members are not weakened.

6) In a welded joint has high strength often more than parent metal.

8.6.3 Disadvantages

1) Since there is uneven heating and cooling during fabrication therefore the members may get distorted as additional stresses may develop.

2) It requires a highly skilled labour and supervision.

3) No provision for expansion and contraction in the frame, therefore there is possibility of cracks.

CHAPTER 9

FUTURE SCOPE

As this project is only for demonstration purpose, in future we can increase the size of the coreless generator and hence the power generation capability.

The current existing wind application generators can be replaced with coreless generator to have an efficient lossless power generation.

The coreless stator and rotor concept can also be applied to the electric motors.

Chapter 10
Conclusion

Thus the Coreless Generator is designed successfully. The output will be verified after the successful completion of the project Hardware.

The project which has stator with no core i.e. ‘air cored’, reduces the iron losses in the core thus increasing the efficiency and saving in generation cost. It uses wind energy to rotate turbine blades which is a renewable source of energy available for free of cost, this will help in power generation with zero emissions hence pollution free power generation.

Chapter 11

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