DESIGN AND FABRICATION OF MICRO HYDRO POWER GENERATION SYSTEM

A Main Project Work submitted in partial fulfilment of the requirement for the award of the degree of

Bachelor of Technology
In
Mechanical Engineering

Submitted By

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CERTIFICATE

This is to certify that the project work entitled "DESIGN AND FABRICATION OF MICRO HYDRO POWER GENERATION SYSTEM" that is being submitted by T SAI DHEERAJ (17091A0372), C PRAVEEN KUMAR REDDY (17091A0359), R ABHISHEK (18095A0301), K MOULALI (18095A0319), S VENKATA KIRAN KUMAR REDDY (17091A03A0) for the fulfilment of the award of Bachelor of Technology in Mechanical Engineering in Rajeev Gandhi Memorial College of Engineering & Technology (Autonomous) and this is a record of Bonafede work carried out by them under the guidance and supervision. The results embodied in this project work have not been submitted to any other university or institute for the award of any degree.

Signature of Guide

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ABSTRACT

As energy becomes the current catchphrase in business, industry, and society, energy alternatives are becoming increasingly popular.

Hydroelectricity exists as one option to meet the growing demand for energy and is discussed in this paper.

The hydro-powered generator uses fast-flowing water that are usually located on storage tank.

A small-scale system is comprised of an intake, a pipeline, a turbine and a generator. The water is collected via an intake area then transferred from the stream through a long pipe (also known as a penstock). Micro hydro is a type of hydroelectric power that typically produces from 5 W to 10W of electricity using the natural flow of water.

In the present project work it is proposed to prepare a prototype of Micro Hydro Power Generation System (MHPG). Thus, prepared MHPG is arranged to a water flow line to generate the power. The power generator is measured at various velocities by varying the load. The various parameters like Torque, Power etc. are analysed at constant velocity for different loads. It is found that at 0.25kg of load maximum torque of 0.0245 N-m and minimum torque of 0.0049 N-m at 0.05kg of load. The maximum power of 1.32W, maximum torque of 0.0245 N-m is produced at 0.25kg.

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CHAPTER-1

INTRODUCTION

We all know that electricity is one of the most important discoveries in human race and it has become the most widely used source of energy to be used in almost every aspect in generating power. Power is a basic part of nature and it is one of our most widely used forms of energy. We get power, which is a secondary energy source, from the conversion's other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources.

Most machines that make electricity need some form of mechanical energy to get things started. Mechanical energy spins the generator to make the electricity.

In the case of hydroelectricity, the mechanical energy comes from large volumes of falling water. The simplest way to produce the volumes of falling water needed to make electricity.

In this activity, we will use a small propeller or turbine to build a model of a simple mini hydro power generation system. It generates surprising amount of electricity, provided you have a supply of pressurised water, such as from a lab sink.

1.1 Power generation systems:

- Steam power plant
- Geothermal power plants
- Gas power plants
- Nuclear power plants
- Wind power plants
- Hydro power plants

Energy sources are valuable for their abilities to generate electricity, heating and other necessities of Industrial & Commercial life and modern home requirements. While conventional forms of energy, which

CHAPTER-2

LITERATURE REVIEW

1. Hydropower will play an increasingly important part in supplying electricity in low-income countries in Africa and Asia over the next 30 years.
2. Existing hydropower schemes should be "re-operated", improved and rehabilitated before investing in new infrastructure - The largest enhancements in the performance of existing hydropower will be where the key components such as vii turbines have deteriorated and can be replaced, or operations can be changed (i.e., "re-operated") to benefit ecosystem services, irrigable agriculture and water supply without significantly compromising power generation.
3. New hydropower schemes need to be assessed within the context of comprehensive catchment-wide planning.
4. There is a paucity of suitable hydrological data with which to plan new hydropower schemes in many low-income counties - Hydropower schemes based on limited and unreliable hydrological data have the potential to underperform and not to attain the benefits the infrastructure is designed to generate. In recent years there has been a significant decline in the number of hydro-meteorological stations in many low-income countries.
5. Emphasis should be placed on investing in hydropower schemes that maximise flexibility and adaptive management.
6. Climate change scenarios should be incorporated into the planning and design of new hydropower schemes - There is evidence to suggest that the effects of climate change are not being considered when new hydropower schemes are being planned. More work is required to assess the impacts of climate change uncertainty on proposed hydropower schemes in lowincome countries relative to other variables (e.g., capital

CHAPTER-3

COMPONENTS REQUIRED

3.1List of components:

1. Turbine
2. Casing
3. DC Generator
4. Shaft
5. Bearing
6. Pipe

3.2 Turbine:

A Turbine is an impulse-type water turbine invented by American inventor Lester Allan Pelton in the 1870s. The Pelton wheel extracts energy from the impulse of moving water, as opposed to water's dead weight like the traditional overshot water wheel. Many earlier variations of impulse turbines existed, but they were less efficient than Pelton's design. Water leaving those wheels typically still had high speed, carrying away much of the dynamic energy brought to the wheels. Pelton's paddle geometry was designed so that when the rim ran at half the speed of the water jet, the water left the wheel with very little speed; thus, his design extracted almost all of the water's impulse energy—which allowed for a very efficient turbine.

3.2.1Working principle of turbine:

The high-speed water jets emerging from the nozzles strike the buckets at splitters, placed at the middle of a bucket, from where jets are divided into two equal streams. These streams flow along the inner curve of the bucket and leave it in the direction opposite to that of incoming jet. The high-speed water jets running the Pelton Wheel Turbine are obtained by expanding the high-pressure water through nozzles to the atmospheric pressure. The high-pressure water can be obtained from any water body situated at some height or streams of water flowing down the hills. The change in momentum (direction as well as speed) of water stream produces an impulse on the blades of the wheel of Pelton Turbine. This impulse generates the torque and rotate the shaft of Pelton Turbine the impulse received by the blades should be maximum possible. That is obtained when the water stream is deflected in the direction opposite to which it strikes the buckets and with the same speed relative to the buckets.

Fig.no. 3.1 Turbine

3.3Casing:

A turbine casing for a hydro turbine comprises a casing defining the boundary of part of the turbine flow duct and formed from a plurality of segments, each segment being mounted from fixed structure by a plurality of radially extending struts.

CHAPTER-4

MODELING AND FABRICATION

Modelling of the turbine, casing is done by using CATIA V5 R20 software.

4.1 INTRODUCTION TO CATIA

CATIA is an acronym for Computer Aided Three-Dimensional Interactive Application. It is one of the leading 3D software used by organizations in multiple industries ranging from aerospace, automobile to consumer products.

CATIA is a multi-platform 3D software suite developed by Dassault Systems, encompassing CAD, CAM as well as CAE. Dassault is a French engineering giant active in the field of aviation, 3D design, 3D digital mock-ups, and product lifecycle management (PLM) software. CATIA is a solid modelling tool that unites the 3D parametric features with 2D tools and also addresses every design-to-manufacturing process. In addition to creating solid models and assemblies, CATIA also provides generating orthographic, section, auxiliary, isometric or detailed 2D drawing views. It is also possible to generate model dimensions and create reference dimensions in the drawing views. The bi-directionally associative property of CATIA ensures that the modifications made in the model are reflected in the drawing views and vice-versa.

The first release of CATIA was way back in 1977, and the software suite is still going strong more than 30 years later. While CATIA V6 is just being released, the most popular version of CATIA is V5 which was introduced in 1998. That said, it is important to note that each version of CATIA introduces considerable additional functionality. For example, V4 (introduced in 1992) offered enhancements to the Assembly Modelling Product including easy-to-use graphical treebased assembly management. V5 and V6 saw changes in the way data is handled. Dassault Systems typically offers new updates, releases and bug fixes

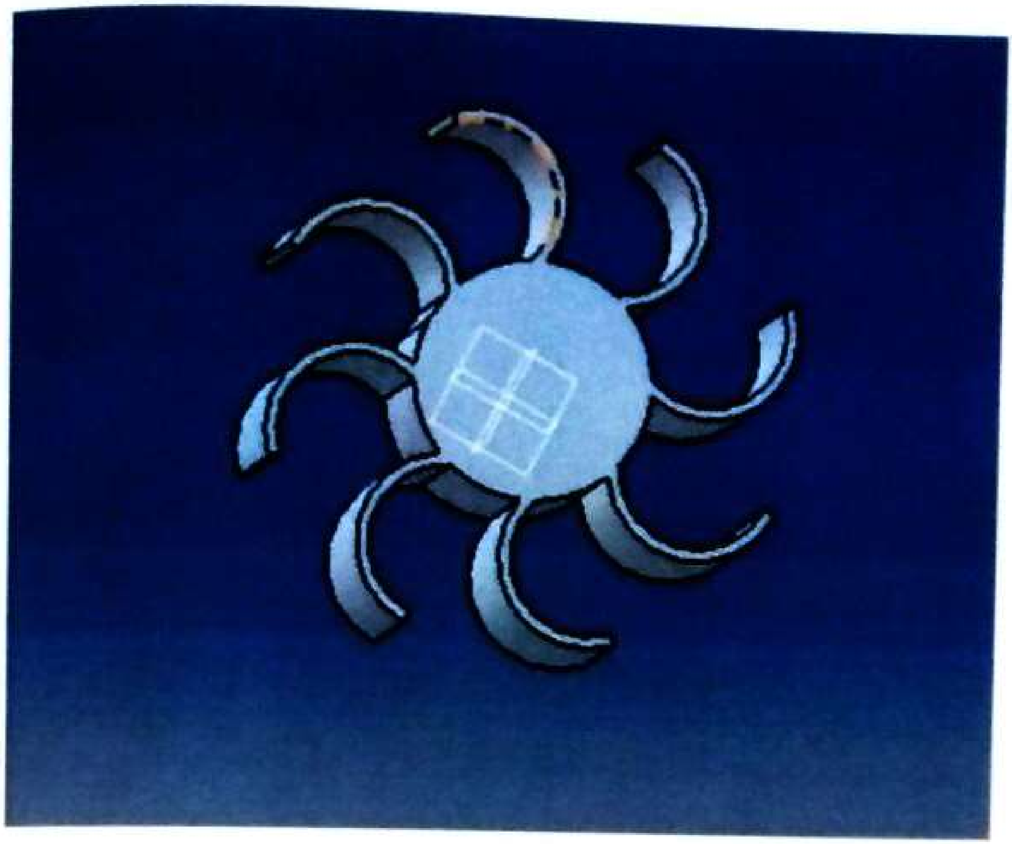

Fig.no 4.4 Turbine

Casing:

This casing is used to protect the turbine from the running of water. It will withstand the running of water or running of turbine.

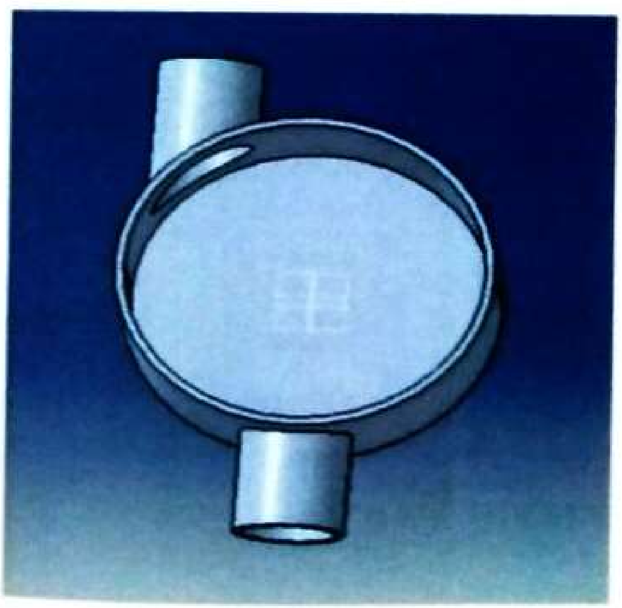

Fig.no 4.5 Casing

CHAPTER-5

EXPERIMENT AND CALCULATIONS

5.1 WORKING PRINCIPLE:

The water is collected into the tank, so it serves as a water reservoir. The potential energy for further work is generated by the water level.

Due to the head maintained in the tank the water flow through the pipe with some velocity. This high velocity flowing water strikes the turbine shaft. Due to this head, there will be potential energy. By opening the inlet valve this potential energy will convert into kinetic energy.so the turbine will be rotated. This kinetic energy is converted into mechanical energy by rotation of shaft. As the turbine shaft is compiled to the generator the power is generated.

5.2 Procedure:

1. A turbine is fabricated and fixed into a casing.
2. A D.C. generator is fixed to the shaft & turbine.
3. Now we should attach the valve to the inlet of the turbine by using the threading's.
4. Connect a pipe to the inlet valve such that the water flows through the turbine.
5. The water flow of the turbine to controlled by the valve we fixed to the component.
6. From the generator we draw power through wires. The wires are connected to the socket such that we can use this Power.
7. Now we allow the water to flow through the turbine by adjusting the inlet valve. We should change the velocity of water by adjusting valve.
8. Note the velocity readings in the table.
9. Due to the flow of water the turbine rotates and generates

CHAPTER-6

ADVANTAGES, DISADVANTAGES

&

APPLICATIONS

6.1 Advantages:

- No fuel is required.
- Economic energy resource.
- There is no air pollution.
- Long life when compared to thermal and nuclear power plant.
- The cost of equipment is very low.
- Utilize natural flow of water in pipes.
- Easy to manufacture the device.

6.2 Disadvantages:

- Low power generation.

6.3 Applications:

- The generating power is used to charging mobile phones, to lightning the bulb etc...
- It is used to run the sensor tap by connecting this device.

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