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Vortex Bladeless Wind Mill

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ABSTRACT: Vortex bladeless turbine antiquates the conventional wind turbine and adopts a radically innovative and novel approach to captivate the moving wind energy. This device effectively captures the energy of vortices, an aerodynamic instability condition. As the wind passes a structure, the flow steers and cyclical patterns of vortices are generated. Once the strength of wind force is suffice, the structure starts vibrating and reaches resonance. Vortex bladeless is a vortex induced vibration resonant power generator. It harnesses wind energy from a phenomenon of vortices, called vortex shedding effect. Clearly bladeless technology consists of a cylinder fixed vertically on an elastic rod, instead of tower, nacelle and blades which are the crucial parts of a conventional wind turbine. The cylinder oscillates on a specifically mentioned wind range, which then generate electricity through an alternator and a tuning system. In this paper the vortex turbine is designed with certain existing parameters of dimensions in Solid works and the same is analyzed for different materials and dimensions of mast, which is an important part in the vortex turbine. Also various performance parameters like displacement, frequency etc. Are also compared among different models.

KEYWORDS: Cone Pipe, Discs, Piezoelectric System, Springs, Bladeless windmills, deflection, renewable energy source, vortex shedding effect, vortex-induced vibration.

I.INTRODUCTION

Man has needed and used energy at an increasing rate for his sustenance and well-being ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by eating plants or animals, which he hunted. Subsequently he discovered fire and his energy needs increased as he started to make use of wood and other bio mass to supply the energy needs for cooking as well as for keeping himself warm. With the passage of time, man started to cultivate land for agriculture. He added a new dimension to the use of energy by domesticating and training animals to work for him. With further demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling water to turn water for sailing ships and for driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say thatthe sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy. A blade less wind mill or damper is a mechanical device designed to smooth out or damp shock impulse, and dissipate kinetic energy. Pneumatic and hydraulic blade less wind mills commonly take the form of a cylinder with a sliding piston inside. The cylinder is filled with a fluid (such as hydraulic fluid) or air. This fluid-filled piston/cylinder combination is a dashpot. The blade less wind mills duty is to absorb or dissipate energy. One design consideration, when designing or choosing a blade less wind mill, is where that energy will go. In most dashpots, energy is converted to heat inside the viscous fluid.

Not much developments are progressed in this field of study. The journal paper describe the vortex induced vibration used for harvesting energy. The various physical phenomenaand concepts related to this area is elaborately discussed. The different problems encountered in conventional windmill are highlighted. The possibility of using Piezo-electric material for maximizing the amplitude of oscillation of vertical windmill is emphasized. Various terms related to bladeless wind power in this paper we can study of the vortex induced vibrations for producing energy with the various methods of the wind power energy are discussed. For the generation of wind energy the various phenomenon and concepts are used is also discussed. Also the various problems in the conventional wind power harvesting are also discussed. From this paper we also understand that by using a piezoelectric material in the oscillation of wind power harvesting type model is also better way to produce electric energy. The main aim of this project is to effectively conduct design, analysis and experimental of vortex bladeless windmills. The study focuses on maximize the deflection of bladeless windmills which is used to produce electricity in future with experimental and geometrical.

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- To design vortex bladeless windmill with existing parameter of dimension in CATIA V5.
- To correlate existing windmill in ANSYS 16.0.
- To modify windmill for better results.
- To modified windmill design in ANSYS16.0.
- To analyse under different material and dimension of mast this is important part inwindmill.
- To correlate FEA with actual experiment.
- Also apart from these, the primary objective is to maximize

- **CONE PIPE:** A frustum shaped structure made up of stainless steel (gauge 26) is used. It absorbs the aerodynamic effect taken from the environment and oscillates with theparticular amplitude to generate energy which it later transfers to the corresponding components.

DISCS: Two circular discs made of iron are used. On one of the discs, the mast is welded and is used for uniform application of induced stress on the piezoelectric chips, and the other disc is used to place the piezoelectric chips.

PIEZOELECTRIC SYSTEM: It is used to generate an electric charge on the application of mechanical stresses. It consists of various subcomponents like PCB board, Diodes, capacitors, etc. Quartz shows a strong piezoelectric effect perpendicularly to the prism axis. Applying pressure on a quartz crystal generates an electrical polarization along the pressure direction
.

SPRINGS: Four helical springs with one end connected to the circular disc and another end to the foundation of the device. They are used to provide vibratory motion as well as constraint motion to the mast.

STAND: It is the base onto which the whole step-up of the mast, disc, and the piezoelectricchip is mounded. It provides strength and support to the mast for its oscillation at highfrequencies. Stand is made up of mild steel materials. The whole above-mentioned parts arefixed in to this frame stand with suitable arrangement.

VOLTAGE REGULATOR: A voltage regulator is a circuit that creates and maintains a fixed output voltage, irrespective of changes to the input voltage or load conditions. Voltageregulators (vrs) keep the voltages from a power supply within a range that is compatible with the other electrical components.

FRAME STAND

Frame stand is made up of mild steel materials. The whole above-mentioned parts are fixedin to this frame stand with suitable arrangement.

VORTEX BLADELESS

Is a Spanish tech startup that developed a multi-patented wind turbine without blades. In2014, vortex bladeless won the south summit award in the category of energy and industryfor the best project. ortex's innovation comes from its unusual shape, where a fiberglassand carbon fiber mast oscillates in the wind taking advantage of the vortex shedding effect.

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VORTEX ATLANTIS

3 meters height and 100w generation capacity, working along with solar panels, mainly tobring energy to an off grid locations.

VORTEX MINI

13 meters height and 4 kw generation capacity, mainly for small-scale/residential wind. Vortex grand: 150 meters height and 1mw generation capacity, capable of generatingelectricity for 400 houses at the bottom of the mast a carbon fibre rod moves inside a linearalternator that generates the electricity, with no moving parts in contact.

BLADE LESS WIND MILL TYPES

There are a number of different methods of converting an impact /collision into relativelysmooth cushioned contact.

METAL SPRINGS

Simply locating metal springs to absorb the impact loads are a low-cost method of reducing the collision speed and reducing the shock loading. They are able to operate in very arduous conditions under a wide range of temperatures. These devices have high stopping forces at end of stroke. Metal springs store energy rather than dissipating it. If metal

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sprint type blade less wind mills are used then measures should be provided to limit Oscillations. Metal springs are often used with viscous dampers. There are a number of different types of metal springs including helical springs, bevel washers (cone-springs), leaf springs, ring springs, mesh springs etc. Each spring type has its own operating characteristics.

ELASTOMERIC SHOCK OBSERVERS

These are low-cost options for reducing the collision speed and reducing the shock loading and providing system damping. They are conveniently moulded to suitable shapes. These devices have high stopping forces at end of stroke with significant internal damping. Elastomeric dampers are very widely used because of the associated advantages of low cost and mould ability together with performance benefits. The inherent damping of elastomers is useful in preventing excessive vibration amplitude at resonance – much reduced compared to metal springs. However elastomeric based blade less wind mills are limited in being affected by high and low temperatures. And are subject to chemical attack. Silicone rubber is able to provide reasonable mechanical properties between temperatures of -50o to +180o deg. C- most other elastomeric has inferior temperature tolerance.

HYDRAULIC DASHPOT

This type of blade less wind mill is based on a simple hydraulic cylinder. As the piston rod is moved hydraulic fluid is forced through an orifice which restricts flow and consequently provides a controlled resistance to movement of the piston rod. With only one metering orifice the moving load is abruptly slowed down at the start of the stroke. The braking force rises to a very high peak at the start of the stroke and then falls away rapidly. On completion of the stroke the system is stable - the energy being dissipated in the hydraulic fluid as heat. This type of blade less wind mills are provided with springs sufficient to return the actuator to its initial position after the impacting load is removed.

COLLAPSING SAFETY BLADE LESS WIND MILLS

These are single use units which are generally specially designed for specific duties. They are designed such that at impact they collapse and the impact energy is absorbed as the materials distort in their inelastic/yield range. They therefore are more compact comparedto devices based on deflections within their elastic range.

AIR (PNEUMATIC) SPRING

These devices use air as the resilient medium. Air has a high energy storage capacity compared to metal or elastomer materials. For duties with high loads and deflections the air spring is generally far more compact that the equivalent metal or elastomer device. Due to the compressibility of air these have a sharply rising force characteristic towards the end of the stroke. The majority of the energy is absorbed near the end of the stroke. The force on an air cylinder buffer is determined by the relation PVn=constant. Air springs require more maintenance than meal or elastomer-based springs and the temperature range is restricted compared to metal springs.

SELF-COMPENSATING HYDRAULIC

These devices are similar to the hydraulic dashpot type except that a number of orifices are provided allowing different degrees of restriction throughout the stroke. These devices are engineered to bring the moving load is smoothly and gently to rest by a constant resisting force throughout the entire blade less wind mill stroke. The load is decelerated with the lowest possible force in the shortest possible time eliminating damaging force peaks and shock damage to machines and equipment. These types of blades less wind mills are provided with springs sufficient to return the actuator to its initial position after the impacting load is removed.

CAD MODELLING

The dimensions for the parts were determined analytically which were later used in modelling. The CAD model is created in the CATIA V5 software. The accuracy of any FEA analysis depends on how correctly the modelling work and its meshing number have been carried out. The Part-modelling is done by CATIA V5 software using the below mentioned dimensions.

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Figure.1. CAD Modeling

II.RESULT AND DISCUSSION

The samples of Vortex bladeless windmill was tested in open environmental at 10 ft. height of building to checking the maximum deflection. Firstly the windmill was mounted on the rigid fixture; it was observed that on application of air velocity the windmill began to deflect with 10-30 mm. By comparing FEA analysisresults and experimental results, the deflection of vortex tube is nearly same. After experimentation, it is found that the maximum deflection is more, i.e., 10 to30 mm. Vortex bladeless windmill is mostly used in small application where less amount of electricity is required. It is most preferable solution as compare to conventional windmill due to it have simple in construction, easy to design, easy to manufacture and less space required. The main advantage is that it requires low maintenance cost because of less moving parts. For future use of this project work, we can use this type of windmill for home appliances or where less amount of electricity is requires.

Figure.2.Hardware Model

III.CONCLUSION

This paper work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries. We are proud that we have completed the work with the limited time successfully Piezoelectric materials have the ability to transform mechanical strain energyinto electrical charge. The amount of energy generated depends on the number of passing vehicles and the number of piezoelectric elements on the road. Vehicles that are moving slowly appears to

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generate slightly more energy than faster –moving vehicles, but further research is needed to confirm this piezoelectric power generation system works successfully. It hastremendous scope for future energy/ power solution towards sustainability.

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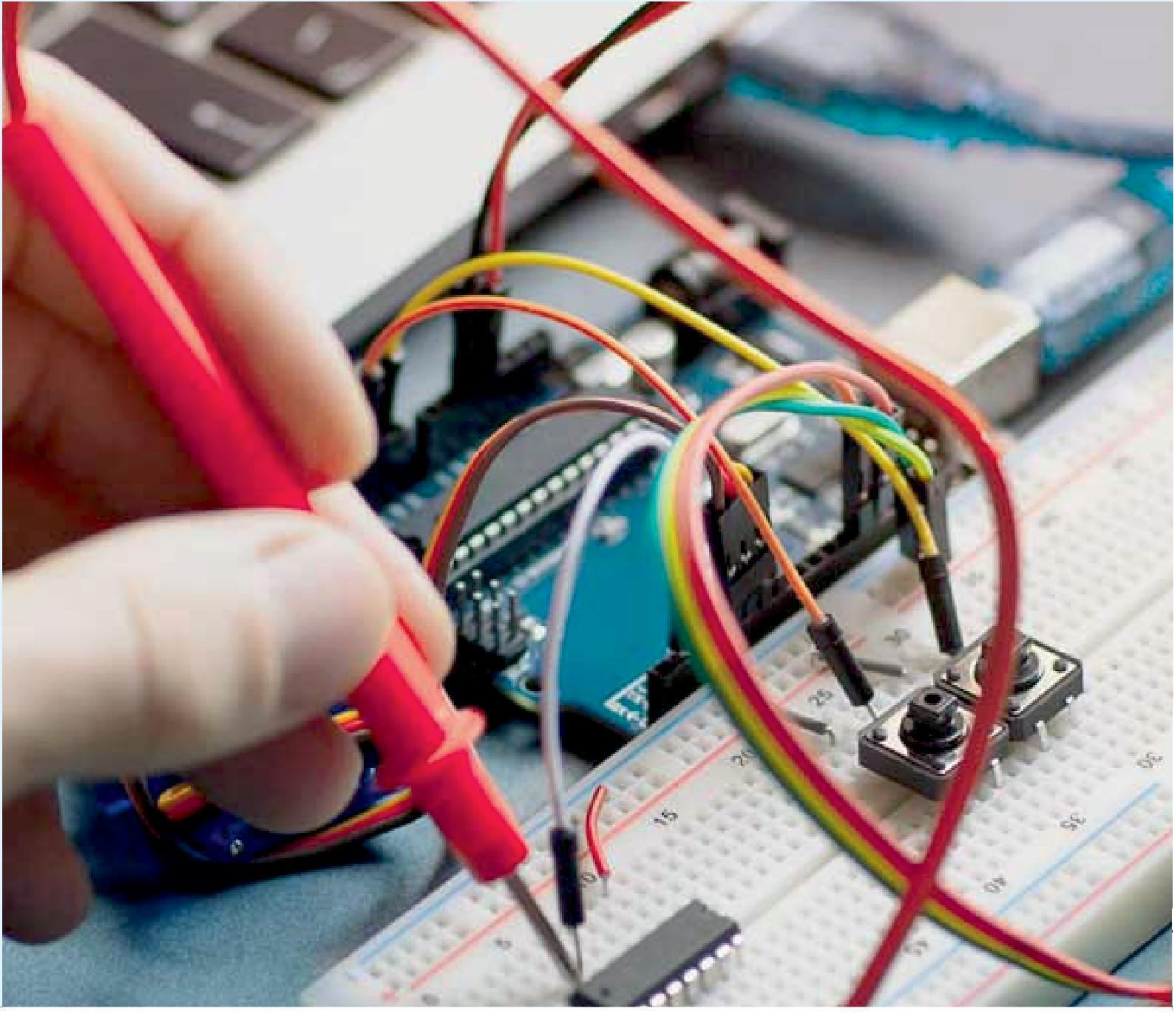

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