

MODELING AND STRUCTURAL ANALYSIS OF HYDRO POWER GENERATION TURBINE

Manumala Venkata Rao¹, D V S R B M Subhramanya Sharma²

¹Pursuing M.Tech in Machine design from Nalanda Institute of Technology(NIT), Siddharth Nagar,
Kantepudi Village, Sattenapalli Mandal, Guntur Dist, AP, (India)

²Associate Professor from Nalanda Institute of Technology (NIT), Siddharth Nagar, Kantepudi
Village, Sattenapalli Mandal, Guntur Dist, AP, (India)

ABSTRACT

A Pelton turbine bucket is the individual fragment which makes up the turbine segment of a Pelton turbine. Essentialness is removed by front lines from high weight water conveyed by the gush fly. The Pelton holder are consistently obliging piece of Pelton turbines. To get by in this troublesome condition, sharp edges routinely utilize wonderful materials. In this errand, we comprehend that the productivity is especially identified with material execution settling on the material decision of fundamental centrality.

Strong metal and Steel are the materials considered for sharp edge in this investigation. The best material is picked by the playing out the couple field examination on the turbine bowl. The key purpose of this wander is to perform coupled field examination of Pelton wheel bowl for different materials and moving the amount of jars on the Pelton wheel for finding the adequacy, high tension dealing with factors. The arrangement model of Pelton wheel bowl is done in Catia V5 R20. Particular parts are created to some degree design workbench and after that social affair are made by acquiring the part plots in the get-together blueprint workbench. Examination is done on Pelton wheel bucket in Ansys 14.5 to know the high uneasiness regions moreover the weights affected in that.

I. INTRODUCTION

Hydro-drive is an old asset of green power. Water from the conduits, lakes, lakes and plants scatters in perspective of sunshine warming. This makes rising of water vapor against gravitational draw of earth. In the environment, it cools and gathers into drops of rain and snow, which falls on grades and mountains. A huge amount of sunshine imperativeness is as yet held in the water as gravitational potential essentialness. Along these lines, sunlight essentialness is a decisive wellspring of hydro imperativeness which on an exceptionally fundamental level tends to set away gravitational imperativeness. It is comprehended that water unendingly streams on the earth surface to fulfill the ocean. This happens in like manner of the round state of the earth that tenders a trademark gravitational draw on surface water. The measure of set away hydro imperativeness is especially identifying with the stature and measure of the water above ocean level. A turbine is the mechanical contraption which debilitates the hydro essentialness of a raised water level by methodology for weight imperativeness (as a result of a response turbine) or by procedure for component essentialness (by prudence of a motivation turbine). The hydro vitality devoured by a turbine is gone to the electrical generator shaft as

mechanical essentialness. A Pelton-wheel is a digressive stream free-fly drive turbine named after an American authority, Lesser Pelton. It is major, successful and the essential water powered turbine which works productively on high heads in abundance of 450 m. The working weight in this turbine stays air as they say. It has major progression and smooth running segments with unimaginable execution characters.

The Pelton wheel isolates imperativeness from the inspiration of moving water, as opposed to its weight like traditional overshoot water wheel. Yet different collections of inspiration turbines existed before Pelton plan, they were less capable than Pelton outline; the water leaving these wheels for the most part still had speed, and passed on an exceptional piece of the imperativeness. Pelton paddle geometry was plot so when the edge keeps running at $\frac{1}{2}$ the rate of the water fly, the water leaves the wheel with low rate, expelling the vast majority of its essentialness, and considering a remarkably successful turbine.

Turbines can be all around named steam and weight driven turbines. The weight driven turbines are turning machines which change over the potential pioneer of the water into supportive sorts of imperativeness, for instance, mechanical essentialness and electrical imperativeness. The weight driven turbines are again sub isolated into inspiration and reaction turbines. The Pelton wheel turbine which is overseen in this journal is an inspiration sort of turbine and to be to a great degree correct this is a Micro hydro turbine. Little scale hydropower plants are a significant wellspring of essentialness in the common scopes of northern India and Nepal. The Pelton turbine includes basically the going with

parts: -

1. Containers
2. Spouts
3. Governors
4. Valves.

The can is of the kind of a twofold hemispherical glass fitted onto a sprinter. The water plane strikes the splitter at the interface of the two areas. The water plane in the wake of striking the splitter it experiences the can profile outwards. The splitters keep up a key separation from the water at an edge between 165-175. The impact imperativeness is changed over into mechanical essentialness which is utilized to turn the sprinter which will be associated with a generator to make the required AC current.



II. DESIGN STEPS OF A PELTON BUCKET

Considering the basic working state of the turbine; the sprinter holder is stationary at beginning stage. The water plane departs the gush at a quick and hits the bucket with high unique speed. In the midst of the normal running of a Pelton turbine a consistent fly of water at different speed is kept up for the endless upheaval of the sprinter. In any case it is the essential stream of water that strikes the holder which has the best impact on the can profile, this is by goodness of the primary water fly needs to pulverize the inactivity powers of the sprinter. Truth be told it is the key water plane fly which passes on the rotational essentialness and torque required for the turn of the sprinter. Thiswork bargains the improvement of a Pelton bucket for considering first effect power of water fly.



Fig.Pelton Runner Model

III. CLASSIFICATION OF HYDRAULIC TURBINES

Hydraulic turbines are ordered likewise to the sort of vitality accessible at turbine channel, stream course through vanes, head at turbine delta

and turbines particular speed. Beneath indicated are some of essential characterization

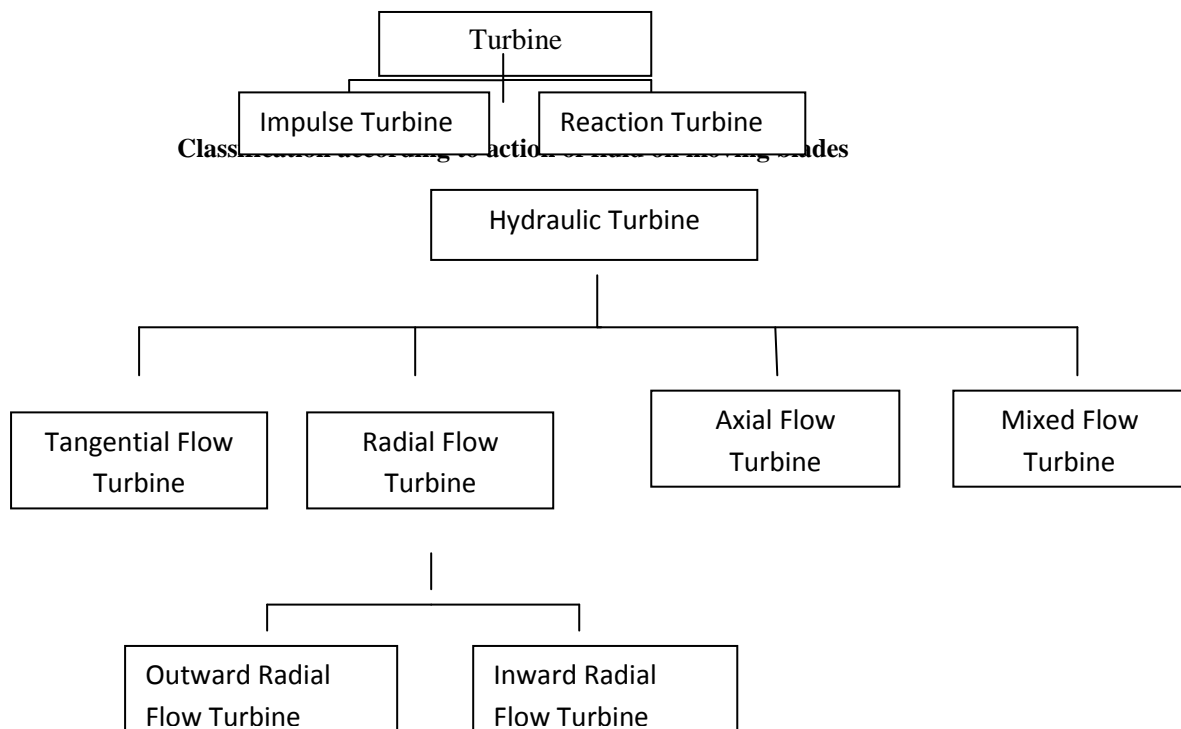


Fig.Classification according to direction of flow of fluid in the runner

IV. PELTON TURBINE OPERATING PRINCIPLE

The Pelton turbine is a motivation turbine that lone proselytes active vitality of the stream into mechanical vitality. The exchange of the aggregate vitality from the spout exit to the downstream Reservoir happens at air weight. The stream coming from the injector encroaches on pails, situated at the fringe of a wheel.

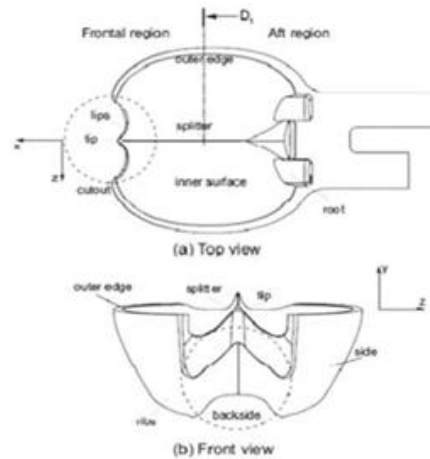


Figure 3: Buckets Geometric Definitions

V. INTRODUCTION TO CAD

CATIA is a totally automation programming which relates with the mechanical field. It is graphical UI which is definitely not hard to learn moreover the item is feature based and parametric solid illustrating. We can draw 2D and 3D models of an area and in like way the social affair of the parts ought to be conceivable in it.

The shape or geometry of the model or assembling is poor upon the qualities which are suggested as objectives. Modules, for instance, sketcher module used to design 2D illustrations, part layout module is used to diagram the 3D models of geometry, and Assembly work arrangement is used to accumulate the different parts which are pulled in the part plot module. Kinematics is used to give the entertainment or development to the part bodies which are arranged and amassed to some degree and get together layout modules.

Displaying Of hydro turbine bucket in Catia

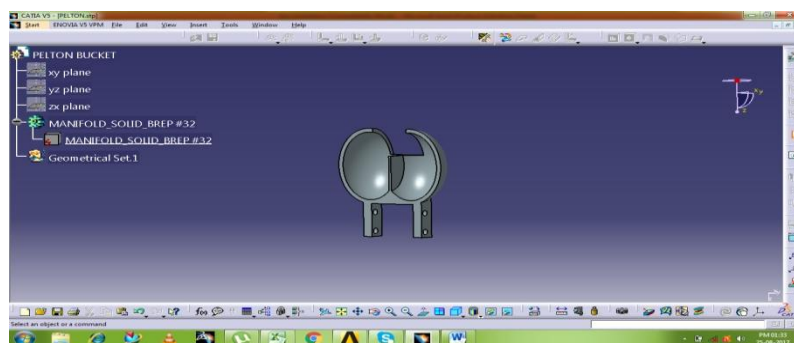


Fig.Pelton Wheel Bucket

VI. FEA

The significant idea in FEA is that the body or structure may be disconnected into more minor fragments of restricted estimations called "Constrained Elements". The main body or the structure is then considered as an

assortment of these parts related at a set number of joints called "focus focuses". Clear cutoff points are approximated the clearings over each obliged section. Such recognized points of confinement are called "shape limits". This will suggest the advancement inside the sections like the development at the focuses of the fragments.

The Finite Element system is a sensible gadget for settling standard and deficient differential relationship in light of the truth it is a numerical gadget, it can manage the capricious issue that can be implied in differential logical announcement from. The usage of FEM is unfathomable as respects the strategy of normal arrangement issues. In light of high cost of taking care of power of years traveled by, FEM has a foundation set apart by being utilized to manage complex and cost essential inconveniences.

Structural Analysis of Pelton Wheel Bucket

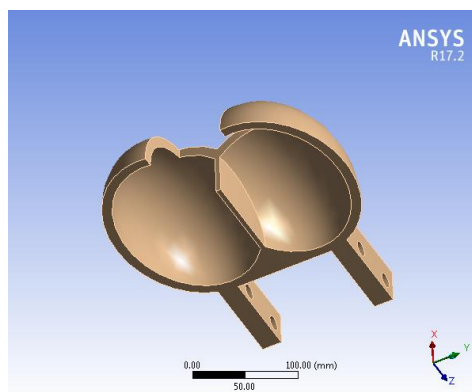
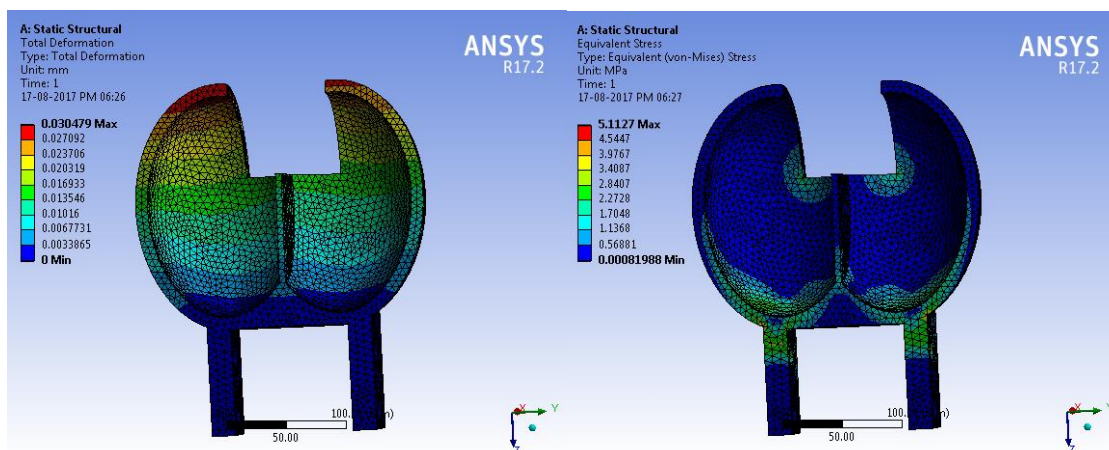


Fig.Imported model of Peltonwheel bucket in Ansys.

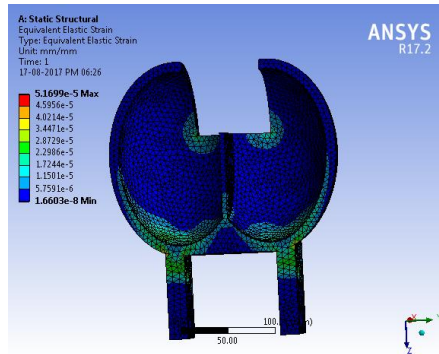
Material Type : cast iron

Total deformation

Equivalent Stress

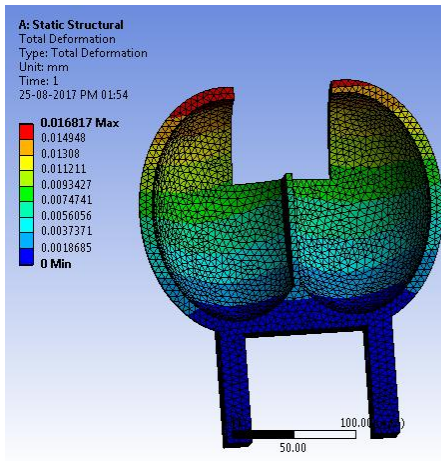


Equivalent Strain

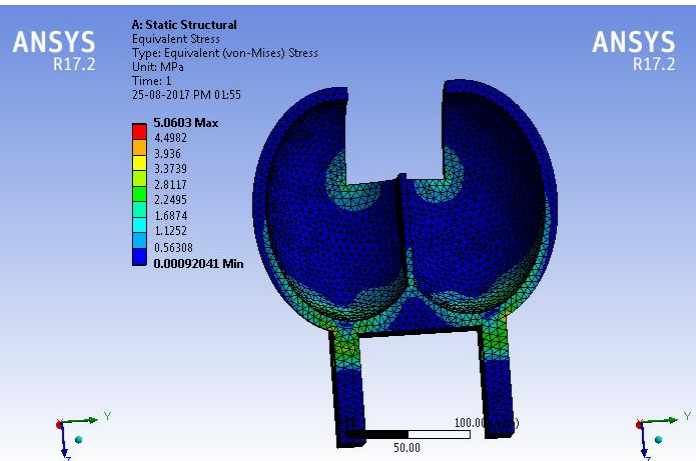


Material Type: fibar glass

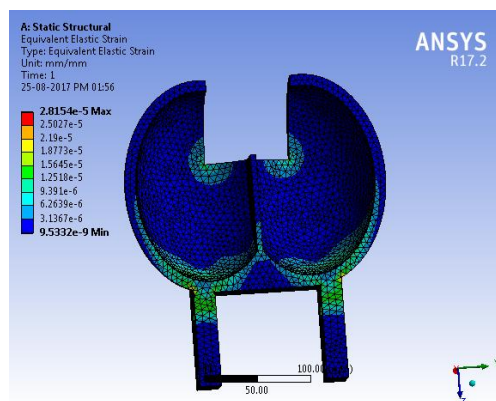
Total Deformation



Equivalent Stress



Equivalent Strain



VII. RESULTS AND DISCUSSION

Numerical values obtained during analysis:

Values observed during structural analysis of Pelton wheel Bucket:

	Total deformation(mm)	equivalent stress MPa	Equivalent elastic strain (mm/mm)
STEEL	0.030479	5.1127	2.84545
CAST IRON	0.065055	5.0603	0.00018091
FIBER GLASS	0.016817	5.0603	5.1699e-5

VIII. CONCLUSION

Our project is to design and analysis of both pelton bucket and pelton turbine on different material namely steel, cast iron and fiber glass reinforced plastic. We have designed piston using CAD software namely CATIA V5 and analysis is done using ANSYS 17.2 and the thermal and static analysis is drawn under required boundary conditions.

We have observed that fiber glass reinforced plastic shows good results when compared to other material and regular using material i.e. cast iron. In static analysis fiber glass reinforced plastic shows lower deformation and less affected to stress and strain factors when compared to different materials even steel shows nearly equal results as fiber glass reinforced plastic which can be encouraged after fiber glass reinforced plastic. By this project we want to conclude that by using fiber glass reinforced plastic in place of cast iron shows good physical bearable properties. We even conclude that steel is also comparatively good material.

REFERENCES

- [1.] A. Atish Gawale, A. Shaikh and Vinay Patil, "Nonlinear Static Finite Element Analysis and Optimization of connecting rod World Journal of Science and Technology, Vol. 2(4), pp .01-04, 2012.
- [2.] A. R. Bhagat, Y. M. Jibhakate, Thermal Analysis and Optimization of I.C. Engine Piston Using Finite Element Method, International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.4, pp.2919-2921, 2012.
- [3.] Kamo R., Assanis D.N., Bryzik W.: Thin thermal barrier coatings for engines. SAE Transactions 1989, No 980143.
- [4.] Ekrem Buyukkaya, "Thermal Analysis of functionally graded coating AlSi alloy and steel pistons", Surface and coatings technology (2007)

AUTHOR DETAILS

- [1.] Manumala Venkata Rao Pursuing M.Tech in machine design from Nalanda Institute of Technology (NIT), Siddharth Nagar, Kantepudi village, Sattenapalli Mandal, Guntur dist, AP, INDIA
- [2.] D V S R B M SUBHRAMANYA SHARMA working as associate Professor from Nalanda Institute of Technology (NIT), Siddharth Nagar, Kantepudi village, Sattenapalli Mandal, Guntur dist, AP, INDIA