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Design and Strength Check For Turbine Inlet Butterfly Valve Using Computational Testing Method

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Abstract- *Butterfly valves are used to control discharge of fluids in penstock of hydropower plants or industrial pipe networks. It has a disc installed in between which can be made to rotate manually or automatically by pneumatic servomotors. These valves are also used as complete shut off valve. The disc of butterfly valve is subjected to pressure of fluid flowing in pipes which tries to deform it. The resistance to this pressure is offered by disc when stresses are induced in it. For safe working of butterfly valves, it is necessary that the stresses induced do not exceed elastic limit otherwise it will lead to its permanent deformation. The 3D modeling to be performs for butterfly valve by using CAD software. Further the stress & displacement FEM analysis of the butterfly valve to be performed by using ANSYS tool to evaluate the optimized result.*

Keywords:- Butterfly Valve, FEM, CAD design, Stress, Deformation, CATIA, ANSYS.

Introduction

Hydro control is considered as a standout amongst the most efficient and non-dirtying wellsprings of vitality. Power age from the water is named as Hydroelectricity. Hydroelectricity implies power created by hydro control or from the utilization of the gravitational power of falling water or streaming water. A standout amongst the most well-known types of energy age since this type of vitality neither creates coordinate waste issue nor it is subjected to weariness.

Presently a day's more hydro electrical power plants being setup and revamped. Yet at the same time the outline and advancement of hydro electrical power plant depends on the conventional strategies. Accordingly there is a gigantic extent of use of cutting edge's procedure like limited component technique (FEM) for accomplishing greatest conceivable enhancement. In any power plant valves for various reasons for existing are generally required. Regularly it is a closed off valve just before the turbine. Along these lines the turbine might be exhausted without discharging the pole or penstock. What's more the guide vane course is depresserised with the goal that spillage stream is stayed away from.
The butterfly valve is one of the kinds of stop gadgets most generally utilized in hydropower station and frameworks. Its utilization is favored as a result of their generally minimal effort, minimization, light weight, sensible water snugness and straightforwardness of operation.

Essentially: Butterfly valve comprises of a round, focal point formed or open edge moving circle and body. The plate is rotated in the body by two trunnions. At the point when open the plane of symmetry of the circle lies parallel to the penstock pivot.

1. Unit seclusion in multi-unit plants where one penstock bolsters more than one unit.
2. Stops the water stream to the turbine when no water is to be permitted to course through the guide vanes.
3. Stops the water section if there should be an occurrence of crisis that is non-conclusion of guide contraption or in case of low oil weight in the framework.
4. To encourage assessment of water way section.
5. To avoid expansive harm at an inevitable burst of the penstock, a pipe soften valve is ordinarily introduced up the pipe only downstream of the stop valve.

1.1.1 Open position and Closed position

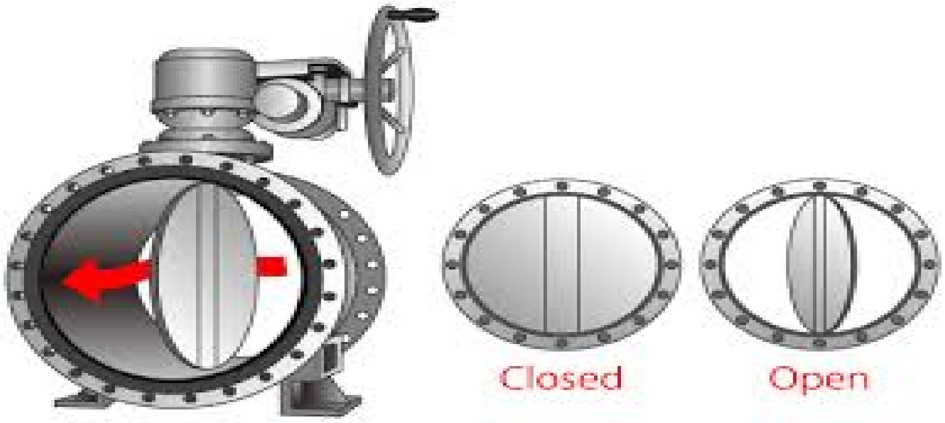

Fig. 1.1: Principle drawings for valves.

II. Methodology

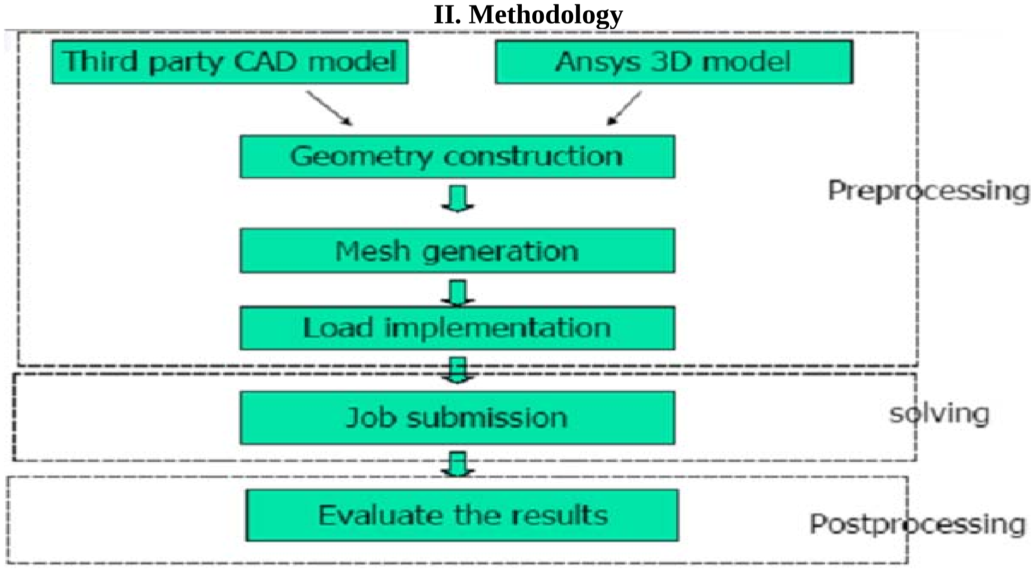

Fig. 2.1: Methodology.

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III. Simulation & Modeling

3.1 Steel Material CAD Model

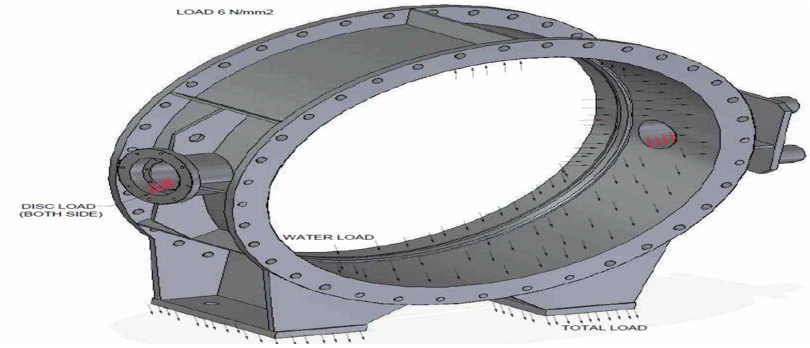

Fig. 3.1: CAD 3D model.

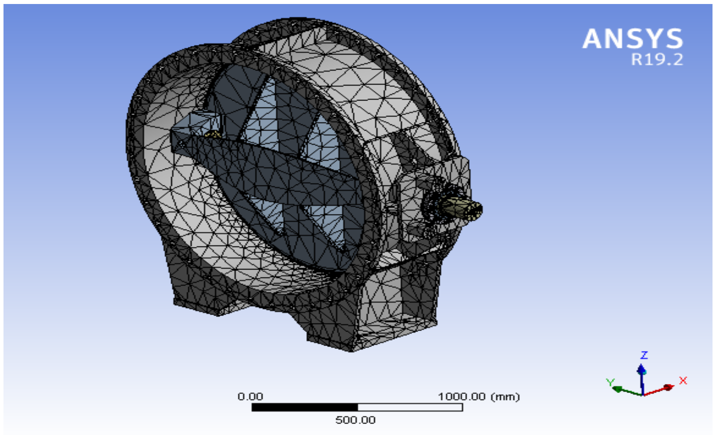

Fig. 3.2: BFV 1500 valve import and mesh toANSYS workbenc 19.2.

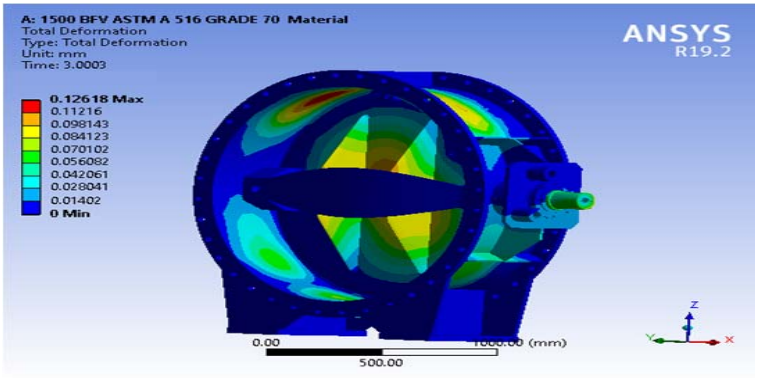

Fig. 3.3: BFV 1500 valve deformation results.

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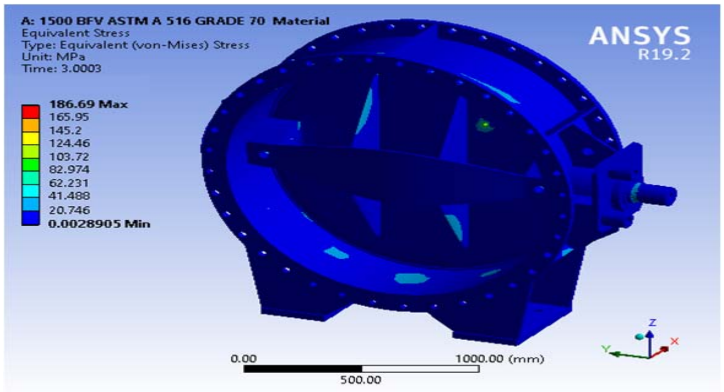

Fig. 3.4: BFV 1500 valve stresses results.

3.2 Cast Iron Material Exiting

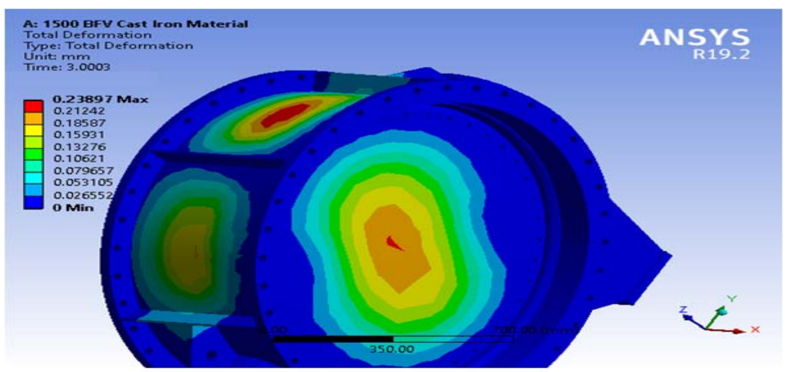

Fig. 3.5: BFV 1500 valve deformation results.

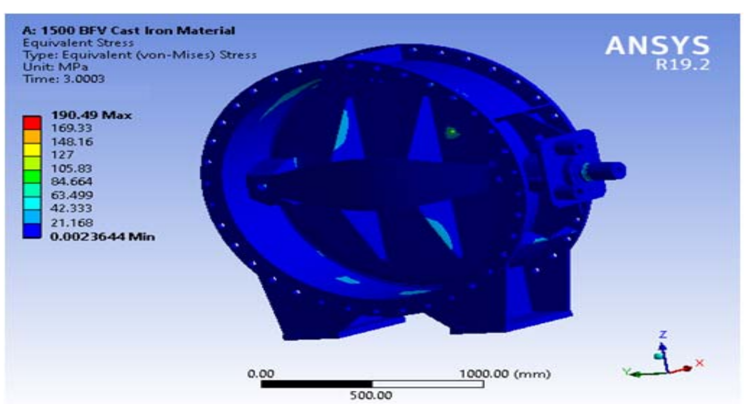

Fig. 3.6: BFV 1500 valve stresses results.

IV. Result & Discussion

Static analysis of finite element of butterfly valve disc &body allows quantitative and qualitative assessment of the state of stress and strain by highlighting critical areas:

- Valve disc - equivalent stress appear in the transition area between support rib and disc seat area.
- Valve body – equivalent stress appear in the surface contact between trunnions disc and hub body.

Von Mises equivalent stresses do not exceed = 225 N/mm^2; than admissible stress value σ_a = 1.5x150 = 225 N/mm^2. Accordance to maximum deformations is produced on the top and bottom of the valve body& valve disc and does not exceed 1.3 mm.

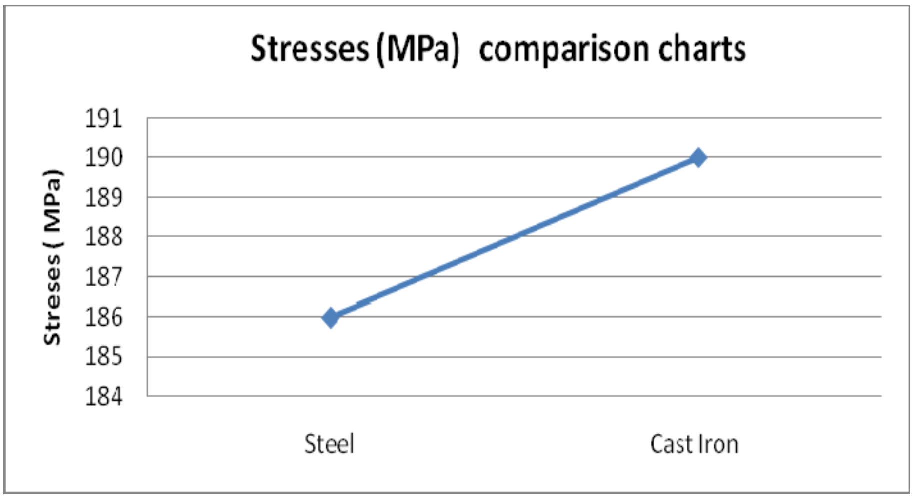

Fig. 4.1: Stresses comparison charts.

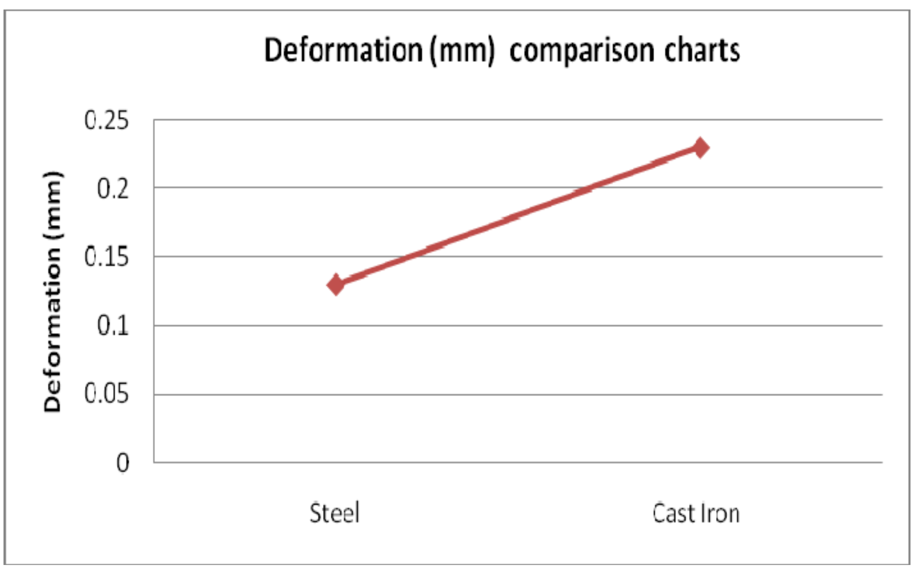

Fig.4.2: Deformation comparison charts.

V. Conclusion

We find that, the Von Mises Stress induced and deformation in the parts of Butterfly Valve because of applied pressure of 0.6 N/mm^2, are less than the yield strength of the material. Hence we conclude that, Design of Butterfly Valve for chosen material is safe.

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