

Review on Topology Optimization of Fabricated Globe valve

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Abstract– A globe valve generally is used to rheostat flow (stream) in a pipeline, containing of a mobile disk-type component and a fixed ring seat in a spherical body. It is about reducing the cost of the in-production Globe valve which used in Sugar industry. This Globe valve is produced by Scrolling Industries Pvt. Ltd. Kolhapur. The company wants to reduce the weight of the globe valve without compromising on the performance parameters. For this it is vital to conduct thorough revision of the same using FEA codes. In this project we are undertaking the Optimization of design of Industrial Valve considering the physical parameters using topology optimization, this will help us to improve the existing designs of the valves by bringing down the cost. In present study, we create the CAD model of Globe valve. Then analysis of the existing design will be performed. Then topology optimization of existing process parameters will be performed. Then analysis of optimized (improved) design will be performed. In final stage publishing of final design will be performed.

Keywords- Globe valve, Optimization of valve.

INTRODUCTION

A globe valve is dissimilar from ball valve. It is a form of valve used in industries for controlling flow in pipeline flow, which consist of a mobile disk-type component and a fixed ring seat in a sphere-shaped body.

Globe valves are termed on basis of sphere-shaped shape. The body of valve is parted by an inner baffle in two halves. It has opening which systems a seat for a mobile plug to be fastened to lock the valve. The movable plug is termed as a disc. In globe valves, movable plug is linked to stem that worked by screw

motion using a hand wheel in labor-intensive type of valves. Usually, automatic globe valves usage smooth and flat stems instead of threaded and can unlocked and locked by the assembly of an actuator.

Body: -

The physique of valve is the chief pressure enclosing configuration of the valve and it recognized very effortlessly as it customs the mass of the valve. It encompasses all valve's interior parts that will be in interaction with the flow being measured by the valve. The bonnet is joined to body of valve and make available the control of the substance that is being organized.

Bonnet: -

The bonnet provides a leak (trickle resistant) proof closure to body of valve. The threaded fragment of the stem goes through a hole with alike threads in the bonnet. Globe valves can have a screw-in, union, or bolted bonnet. Bolt in bonnet is the modest type of bonnet, proposing an enduring, pressure-tight seal. Bonnet made from union bonnet is appropriate for uses with frequent inspection. It also make available the body with additional power. A bonnet joint with bolts is generally used for large or great pressure uses.

Plug or Disc (disk): -

The closing follower of the (plugs) valve linked to the stem is slid or fastened up or below to throttle the flow direction. Plugs are normally of the balanced or unbalanced style. Unstable plugs are solid and used with lesser valves with little pressure through the valve. The benefits are it is simple in design, with one likely leak trail at the seat and ordinarily available at lower cost. The drawbacks are the inadequate size of valves; with a big unstable plug the forces needed to hold the flow becomes impractical. In balanced plug benefits include

tranquil shut off. Though, another trickle track is shaped amid the plug and the cage, and cost of this type is generally higher.

Stem: -

Stem functions as a link between the actuator and the interior of valve which transmits the actuation force. Stems are strung for manual operating valves or smooth and plane actuator regulating valves. The smooth or plane stems are bordered by packaging to stop outflow of material from valve.

Cage: -

The cage is component that covers the plug and situated inside the frame of the valve. Usually, the cage is biggest determiners of flow inside the valve. The design and layout of the openings may have a large effect on flow of material. Cages can also uses to monitor plug to the seat for a well shut off, which substitutes the guiding from the bonnet.

Seat Ring: -

It make available a uniform and stable disposable shut off area of surface. Typically Seat rings held because of pressure from bonnet to the topmost of body. Seat rings can threaded and fastened into a thread cut of the body.



Fig. 1- Globe Valve

LITERATURE REVIEW

P. Ebenezer Sathish Paul, G. Uthaya Kumar, S. Durairaj, D. Sundarrajan has studied structural analysis on valve assembly at different Ball opening position the maximum stress found is 142.65 Mpa in Ball at 50% opening condition and is below yield stress 270 Mpa. The deformation of body is around 0.087178mm. The stress developed in the stem is maximum at 50% opening position is 69.869 MPa. The deformation of the stem is around 0.030869 mm. The stress developed in

Body and Cap is also maximum at 50% opening position is 108.3 MPa and 110.8 MPa respectively, and is below the ultimate stress of the material 450 Mpa. The extreme stress developed in shaft during torque 50 N-m is employed is 69.8 Mpa and is below the ultimate stress in the material 270 Mpa and the component is secure.[1] This research work shows relationships between the design variable of both material and product design domains. They were use calculated fluid dynamics analysis to calculate flow prevention in the form of resistance co-efficient and flow volume co-efficient.

Adrian R. Gamboa Christopher J. Morris Fred K. Forster The micro pump of valve known as immovable geometry valve is a easy device in which the mechanical and fluidic components interact and produces extreme production near resonance. This form have advantages like scalability, toughness, and the easy fabrication in number of materials. We focus on linear dynamic model still last study for design of pump depending on maximum resonance. Here we will optimize the valve shape with 2-D CFD. Six non geometric profile variables was used to optimize tesla valve. Result average ratio of a reverse by forward was 25% higher over Reynolds number. The optimized shape was realized without increase in forward flow resistance. A linear dynamic model, modified to include a number of effects that limit pump performance such as cavitation, used to design pumps based on valve. Prototype plastic pumps were fabricated and tested. Here, we optimize valve shape with 2-dimensional CFD as per optimization procedure.[2]

Vishal A. Andhale, Dr. D. S. Deshmukh has done Experimental observations and software analysis of ball valve. Visual inspection shows the valve meets standard criteria. Conclusions made regarding causes for water leak difficulty. It is because of shrinkage in material of spindle, ball or main body of ball valve during moldings process. It is due to improper size and dimensions of small O-rings which are placed on spindle of ball valve as packing. As there is small bending in spindle during manufacturing and if the complete assembly is improper or if fitting of ball valve nut is not tighten properly; it may increase clearance in ball valve assembly. In this experimental work flow evaluation through Ball valve is accomplished using CFD software. CATIA V5 used for development of model of valve and ANSYS FLUENT is used for analysis. Quantity water leakage is evaluated from numerical calculation and it is equated with experimental outcome.[3]

V. J. Sonawane, T. J. Rane, A.D. Monde, P. C. Gawade
The respective paper shows analysis and modelling of the globe valves. The flow system in globe valve is consist of complex structure and contain nonlinear characteristic as phenomenon of hydraulic and construction are associated with globe valve. In this paper, 3d CFD simulations helps to identify the flow patterns and helps for measuring valve flow coefficient when the globe valve of various flow rate were used in valve. Later on, results of 3d simulation applied in the design of low noise and high efficiency valve for industry.[4]

S. Rammohan, S. Saseendran, S. Kumaraswamy the goal of this study is to represent a three dimensional analysis of flow through globe valve along cage and plug design with the emphasis on the inception and modelling cavitation in detail. Cavitation minimization is done by discontinuing the fluid flow many liquid jet and enhancing turbulence in valve flow. K-epsilon is model which is used for turbulence. In this review, five configurations result of cage with constant flow surfaces area and the stroke of valves are described. The numerical outcome was overviewed with an experimental program applying total flow calculation and the pressure drop made by the valve at total opening. The study was conducted for different jet configurations to quantify the results of the study. Experimental comparison was done in water sample facility with a pressure of 1.8 MPa and flow rate of 0.05 m³ /s. All the equations should be typed using equation editor, equations should not split.[5]

PROBLEM FORMULATION

This is about reducing the cost of the in-production Globe valve which is used in Sugar industry. This Globe valve is produced by Scrolling Industries Pvt. Ltd. Kolhapur. The company wants to reduce the weight of the globe valve without compromising on the performance parameters. For this it is imperious to conduct thorough study of the same using FEA codes.

RESEARCH METHODOLOGY

In present study, we create the CAD model of Globe valve. Then analysis of the existing design will be performed. Then topology optimization of existing process parameters will be performed. Identify the significant parameters and optimization of identified parameters. Then analysis of optimized design will be performed in final stage publishing of final design will be performed.

CONCLUSION

With effective accomplishment of this project, the company Scrolling Industries Pvt. Ltd. Kolhapur will be directly benefited, this solution can reduce the cost of the in-production Globe valve which is used in Sugar industry and will significantly decrease the weight of the globe valve without compromising on the performance parameters.

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