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## Title: “To Reduce the Cost of Fabricated Globe Valve by FEA”

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### ABSTRACT

A fabricated globe valve generally is used to rheostatflow of 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 Industry. 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 finite element analysis, 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 optimization of existing process parameters will be performed. Then analysis of improved design will be performed. In final stage publishing of final design will be performed.

**Keywords-** Globe valve, Optimization of valve.

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## 1.INTRODUCTION

### 1.1 Globe Valve

A valve known as a control device in a larger system; it can be modelled to regulate the flow of material and energy within a process. There are several different kinds of valves (butterfly ball, globe, etc.) selection of which depends on the application and chemical process in consideration. The sizing of valves depends on the fluid processing unit (heat exchanger, pump etc.) which is in series with the valve. Valves are used for variety of reasons including controlling water for irrigation, residential uses and industrial uses for controlling processes.

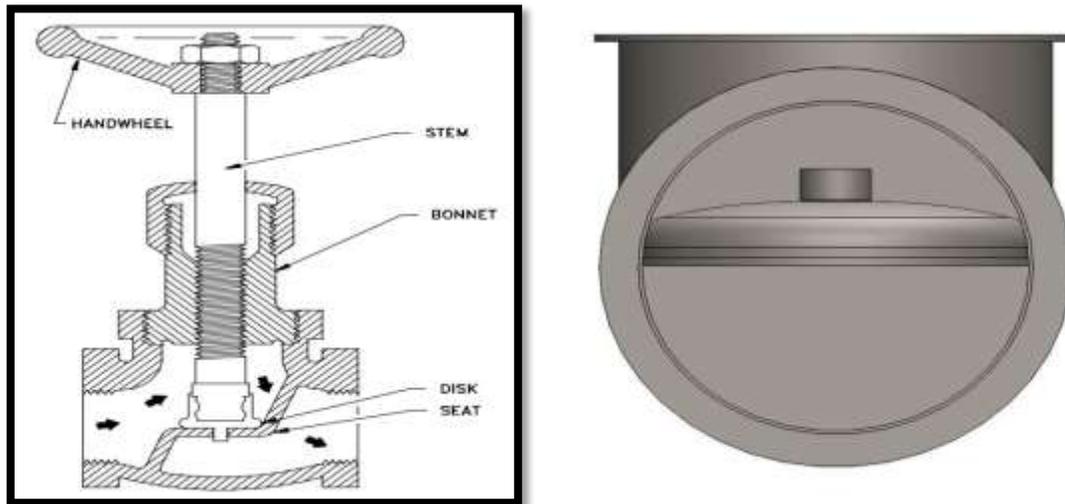
The valves are generally used in industrial applications to control the internal flow of both compressible and incompressible fluids. It used both way in circuit for maintained flow and give in the form of laminar helps to reduced pressure loss.

A valve controls system or process fluid flow and pressure by performing any of the following functions:

- Stopping and starting fluid flow.
- Varying (throttling) the amount of fluid flow.
- Controlling the direction of fluid flow.
- Regulating downstream system or process pressure.
- Relieving component or piping over pressure.

There are several types and design of valves that satisfy one or more of the functions identified above. A multitude of valve types and designs safely accommodate a wide variety of industrial applications.

A globe valve is a linear motion valve used to stop, start, and regulate fluid flow. It is different from ball valve, which is used for regulating flow in a pipeline, consisting of a movable disk-type element and a stationary ring seat in a generally spherical body. Globe valves are named for their spherical body shape. The two halves of the body being separated by an internal baffle. It has an opening that forms a seat onto which a movable plug can be screwed in to close (or shut) the valve. In globe valves, the disk is connected to a stem which is operated by screw action using a hand wheel in manual valves. Typically, automated globe valves use smooth stems rather than threaded and are opened and closed by an actuator assembly.



**Figure1.1 Internal parts of a typical globe valve**

The disk of globe valve can be totally removed from the flow path or it can completely close the flow path. The basic principle of globe valve operation is the perpendicular movement of the disk away from the seat that causes the annular space between the disk and seat ring to gradually close as the valve is closed. This characteristic of globe valve gives good throttling ability that permits its use in regulating flow. Thus, the globe valve may be used for both stopping and starting fluid flow and for regulating flow.

In comparison to a gate valve, a globe valve yields much less seat leakage. This is because the disk-to-seat ring contact is more at right angles, which permits the force of closing to tightly seat the disk.

It is also called as closing-down valves in which the closure member is moved vertically to on and off the seat. In this way the opening of the port is directly proportional to the movement of the disc. Thus, the proportional relationship is ideally suited for duties requiring regulation of flow rate. To have a further precision in regulation the disc element can be available in the parabolic, needle, v port types. Furthermore the short movement of the disc between the open and closed position makes these valves ideally suited for on-off duties. Globe valves are unidirectional valves and are installed so that pressure is under the disk

## **2. LITERATURE REVIEW**

### **2.1. S. Rammohan, S. Saseendran, S. Kumaraswamy**

The objective of this study is to provide a three dimensional analysis of flow through a globe valve with cage and plug design with the emphasis on the inception and development of cavitation in detail. Cavitation reduction is achieved by discontinuing the flow in the form of more than one liquid jet, thereby increasing the turbulence inside the valve flow path. The k-epsilon model was used for turbulence. In this paper the results of five configurations of the cage with constant flow areas and the valve stroke are presented. The numerical results were verified with an experimental program employing total flow measurement and the pressure drop created by the valve at full opening. The study was conducted for different jet configurations to quantify the results of the study. Experimental validation was done in the water test facility with a pressure of 1.6 MPa and flow rate of 0.05 m<sup>3</sup> /s.

## **2.2. Shailesh Wamanrao Lokhande, Dr. A.M. Langde**

There are many valves applicable in industries, one of them is ball valve because it is widely used in power plant to control and regulate the flow through hydraulic plant. It is very important to design the valve that optimum efficiency can be achieved in plant by considering the flowing parameter such as pressure drop, velocity, and viscosity etc. CFD analysis improves the valve life and valve performance in industry at desire valve closing angle such as  $0^\circ$ ,  $15^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  by changing the ball valve shape and checking the pressure drop at certain angle for getting best result.

This paper represent the valve design in such way that optimum efficiency can be achieved in plant by considering the flowing parameter such as pressure drop, velocity, and viscosity etc.

## **2.3. Prabha Kurian, C R Krishnamurthy, Rajesh R**

Globe valve is one of the oldest valve type used for throttling application for all sizes due to better controllability and range. The limitations associated with globe valves in liquid application is difficulty in manual operation due to higher torque, stem bending issue, packing performance deterioration by rotating stem design, leakage etc. This paper focuses on the design and analysis of a symmetric globe valve with focuses on eliminating the problem faced by conventional globe mentioned above. 900 rating is the starting class of high pressure valve and this valve is used for 300MW power plant. Normally this is a closed valve used in feed pump and boiler. All the designs are based on BS and ASME standards. The dimension components in the globe valve is generally based on either standards or arrived during assembly. All the main components are designed and detailed drawing is produced. The stress and flow area analysis is performed on SOLIDWORKS COSMOSXPRESS AND FLUENT SOFTWARE.

## **2.4 V. J. Sonawane, T. J. Rane, A.D. Monde, R.V. Vajarinkar, P. C.Gawade**

Globe valves are generally used in fluid flow control equipment's in many engineering applications. Thus it is more essential to know the flow characteristic inside the valve. Due to the fast progress of numerical technique and flow simulation, it has become possible to observe the flow inside a valve and to estimate the performance of a valve. This paper presents the modeling and simulation of the globe valve. The flow system of globe valves is complex structure and has non-linear characteristics, because the construction and the hydraulic phenomena are associated of globe valves. In this paper, three-dimensional Computational fluid dynamics simulations were conducted to observe the flow patterns and to measure valve flow coefficient when globe valve with different flow rate and constant pressure drop were used in a valve system. Furthermore, the results of the three-dimensional analysis can be used in the design of low noise and high efficiency valve for industry.

## **2.5 J. S. ANAGNOSTOPOULOS and D. S. MATHIOULAKIS**

In this paper a numerical optimization methodology is applied to improve the design of a micro channel structure used in a valve less micro pump. Advanced numerical techniques are implemented for automatic generation of adaptively refined grids and unstructured for the representation of irregular boundaries. Many geometric properties of the micro channel are considered as free design variables, and an optimization software is used to find the best performance design. The latter is specified by the ratio of the pressure drop in reverse flow to that in forward flow from the channel, and represents the flow rectification efficiency, when this is used as a check valve in Zreciprocating pump. The best design is obtained fast and the pressure drop ratio is 50% higher as compared to a standard design. Effects of Reynolds number on the valve performance are also examined. Finally, the dynamic behavior of the valve under periodic flow conditions in a reciprocating micro pump is simulated and discussed. This paper is based on the Numerical simulation of a Tesla-type micro channel element to examine the details of the diodicity mechanism, as well as to optimize its geometry for best flow rectification performance.

## **3. CONCLUSION**

This project is the outcome of optimization of valve by using finite element analysis technique. 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 Industry Kolhapur. The company wants to reduce the weight of the globe valve without compromising on the performance parameters. For this is important to conduct thorough study of the same using FEA codes. Considering problem this project was successfully executed in stipulated time frame. It involved gathering the structural design data from manufacturer, CAD model generation, carrying out finite element analyses (modal and

static), alteration of thickness and modification of the design and validation of modified standard design by carrying out finite element analyses (modal and static).

With successful completion of this project, the company Scrolling Industry 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.

## ACKNOWLEDGEMENT

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.

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