THE FLOW MODELING ON THE CYLINDER VALVE

Prof. dr. eng. Iulian Florescu[1], Assoc. prof. dr. eng. Daniela Florescu[2]

[1,2]"Vasile Alecsandri" University of Bacau, iflorescu@ub.ru, dflorescu@ub.ro

Abstract: *Being performed in a wide range of sizes, cylinder valve has been tested only on hydraulic losses by experimental methods or the values passed and sealing flow. An analysis of flow parameters for different valve openings or hydrodynamic parameters variation in these conditions can give us additional elements of design the optimal mode of operation of the valve.*

Keywords*: cylindrical valve, flow modelling, pressure, velocity, Solidworks Flow Simulation*

1. Introduction

Cylinder valve or Johnson cylinder valve after its inventor's name, has a central cylindrical ends placed coaxially surrounded by hydrodynamic flow of water rotationally symmetric, which is fixed to the housing by transverse frames in the form of wings. This area includes the locking of a cylindrical part axially sliding part which provides for a partial closure hydrodynamic flow continues with minimum load losses, Figure 1 [1].

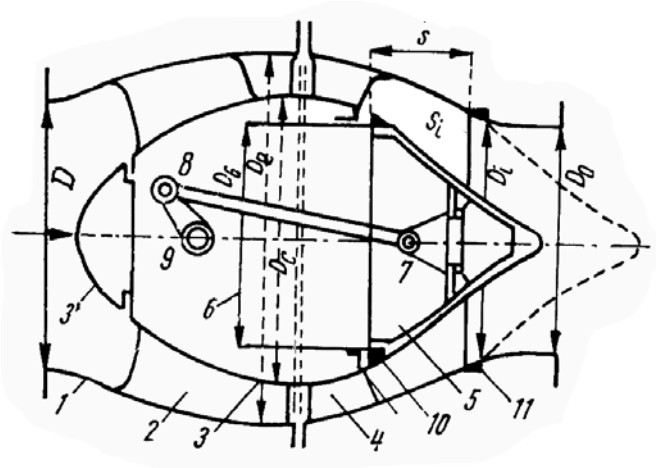


Fig. 1. The components of the cylinder valve [2]:
1 - valve body, 2 - ribs fusel; 3 - intermediate housing 3 '- housing upstream, 4 - ribs fusel
5,6 - closure, 7 - joints, 8 - pivot, 9 - crank, 10 - ring; 11 – collar;

Various types of such valves cylindrical construction were performed according to the destination. In hydropower are used to purge the bottom of the dam or penstocks, are classified according to their size or supply pressure. For sizes up to 1 m ($D < 1m$) for operation of lock body can be achieved by simple mechanisms, such crank and connecting rod, but the size or high pressure is achieved by actuating the gear wheel and threaded rods, pistons or actuators employed. Water flow direction can be left or right depending on the placement of the valve to the turbine or bottom emptying [1, 2, 4].
Being designed to work at pressures of tens of bars or to cope with unsteady flow situations with high overload, it should be possible flow analysis parameters variations depending on input values and design parameters [1, 5].
This theoretical analysis can be done using dynamic simulations allow the study of the influence of a number of physic-mechanical or constructive parameters. Solid Works Flow Simulation Through

these simulations can take benefit on speed and pressure change some constructive shapes and sizes, which can be reflected in the optimal design of cups types of equipment [6, 7].
Using the calculus presented in [1], [2] and [3] we can analyze the influence of parameters on physical-mechanical construction or operation and hence derive dynamic optimal design of these types of valves.

2. The flow modeling

Modeling flow through a cylindrical valve was performed using Solid Works program that allows recording of flow parameter variation at different points of the flow, depending on the modification of the piston stroke. For example have been selected 20 points on each line of the current; first line in the vicinity of the bulb inside the valve, the second line in the middle area of the third flow of water in the vicinity of the outer shell as shown in Figure 2. As the input data are selected the inlet pressure with 4 bars values, and for the outlet pressure is selected the atmospheric pressure.

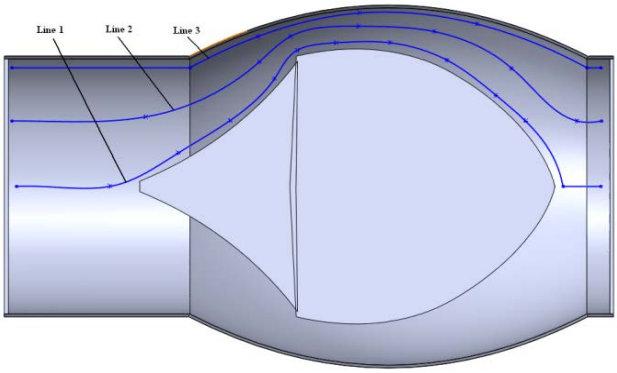
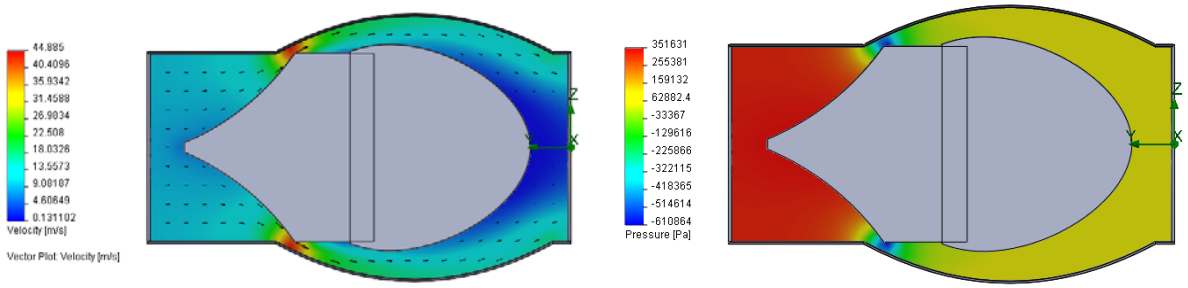


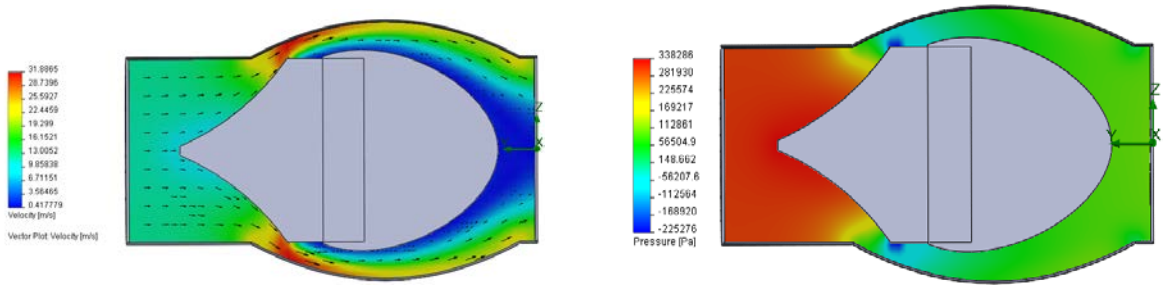
Fig. 2. Position power lines that are followed hydrodynamic parameters

Maximum valve opening is 400 mm and in relation to the position of the shutter will position the openings 100, 200 and 300 mm. For each position of the three current lines are held positioned as in Figure 2.
Velocity and pressure distribution for maximum opening of 400 mm is shown in Figure 3, with traceability streamlines with velocity vectors attached and with limits of values of their respective pressure distribution along the flow.

a.



b.



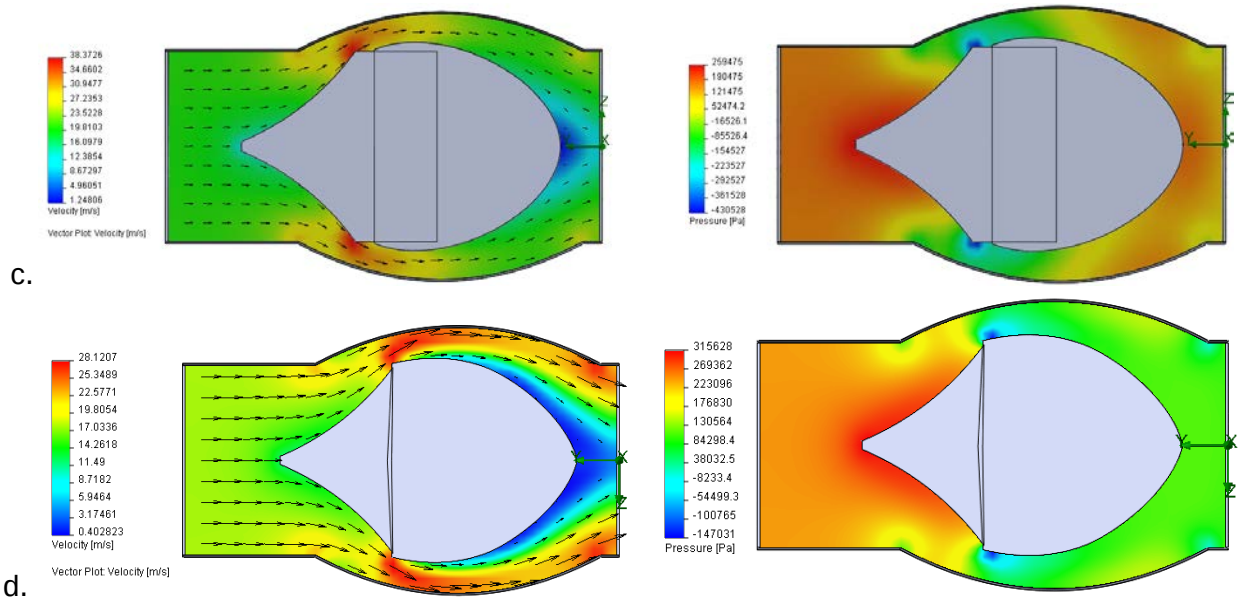
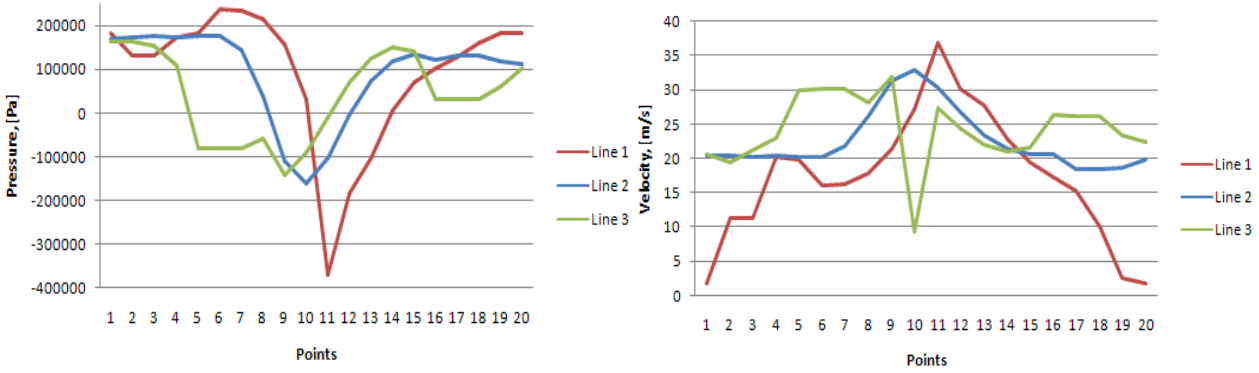


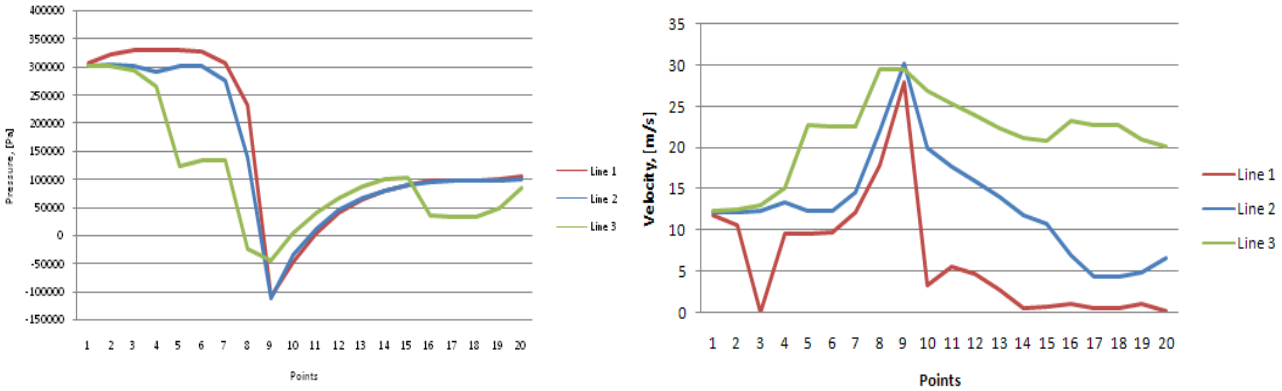
Fig. 3. The distribution of velocities and pressures for different valve openings:
a.100 mm [1]; b. 200mm [1]; c. 300mm; d. 400 mm

To appreciate the value of both parametric variation of different sections hydrodynamic flow in the direction of motion, we considered 20 points evenly distributed between input and output for each power line, figure 4.

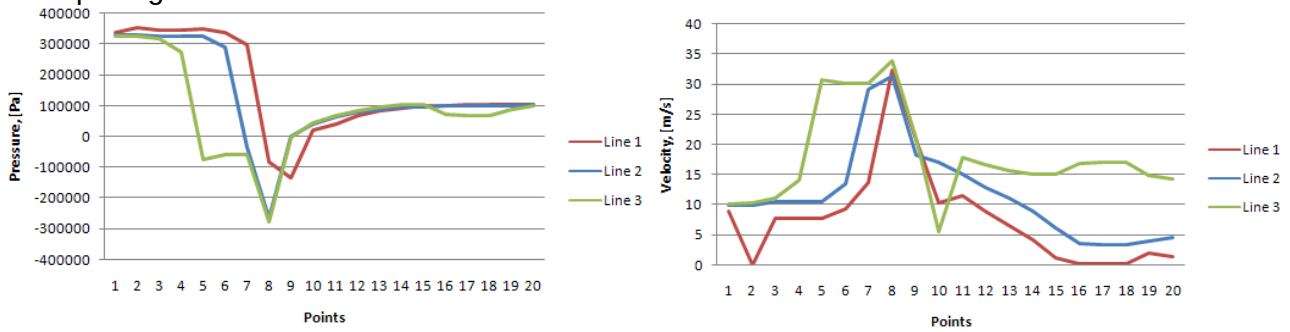
The opening valve is 100 mm



The opening valve is 200 mm



The opening valve is 300 mm



The opening valve is 400 mm

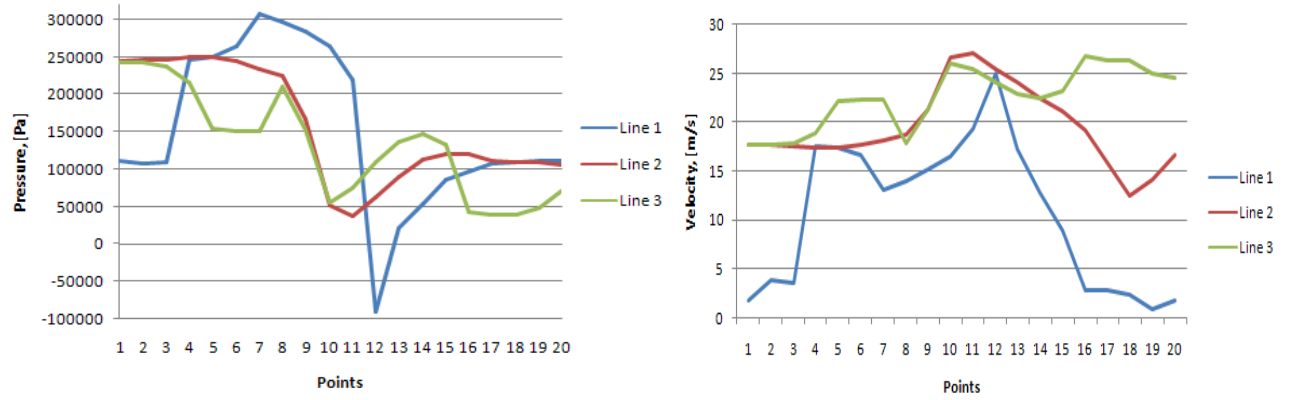


Fig. 4. The variations of velocities and pressures for different valve openings:
a.100 mm; b. 200mm; c. 300mm; d. 400 mm

Note that the pressure variation along the flow properties keep the allure is the schedule for various openings tends to travel in the direction of flow of minimum with increasing valve opening. For speeds are observed to shift the maximum in the flow direction with increasing valve opening. These two trends are normal relationship between dynamic pressure and water flow rate.

Conclusions

For different working fluids with mechanical and physical properties and chemical characteristics known we can estimate the flow through the valve section with important dates regarding the main hydrodynamic parameters. You can get such a spectrum of current flow on different lines, variations of pressure and velocity at different points of the valve. It can analyze phenomena such as cavitations in areas where the pressure may drop to low values close to vapor pressure when there is danger of biphasic mixture (vapor of the liquid used). As a consequence of this theoretical analysis of the flow through the valve cylinder can appreciate different design parameters with implications on the reports sections flow through the valve and connecting pipe section.

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