

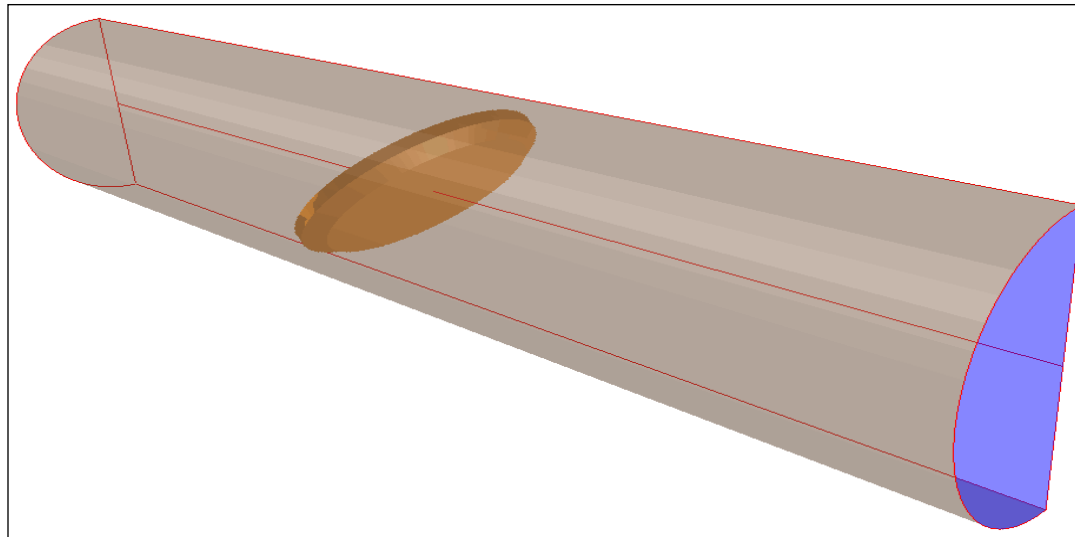


Polar coordinate cases

Butterfly Valve

Seminar

A Butterfly Valve in a pipe is a typical POLAR case for CFD applications. The flow rate through the pipe is controlled by the rotation angle of the valve.



Control engineers need to know how sensitive the flow rate is to fluid pressure and valve angle changes and the consequential implication for hydraulic loss.

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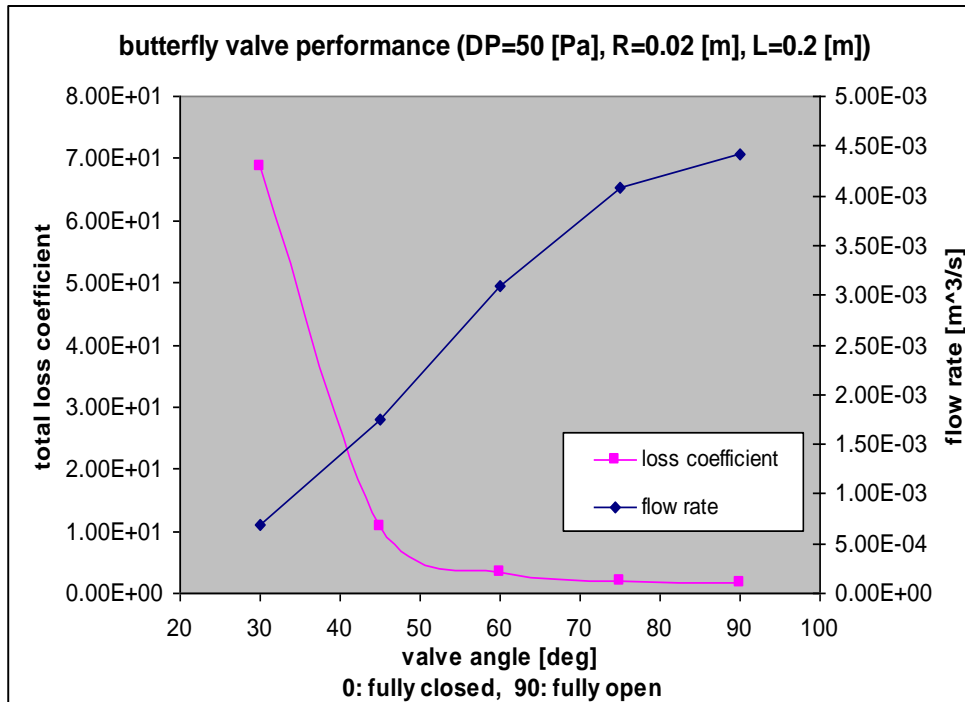


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The demonstration case uses a 40mm diameter of 4mm thickness. The pipe length is 200mm.

Five runs were carried out with different valve openings (with angle 0° fully closed and 90° fully open). The relative working pressure used is 50 [Pa] at the inlet and zero at the outlet.



The results shown give the relationship between valve angle, total loss coefficient and flow rate. The total loss coefficient is high with a small valve opening, and decreases by nearly 90% during the first 45° opening. Correspondingly, the flow rate is almost linearly increased below 50° , before slowly increasing at even wider apertures.

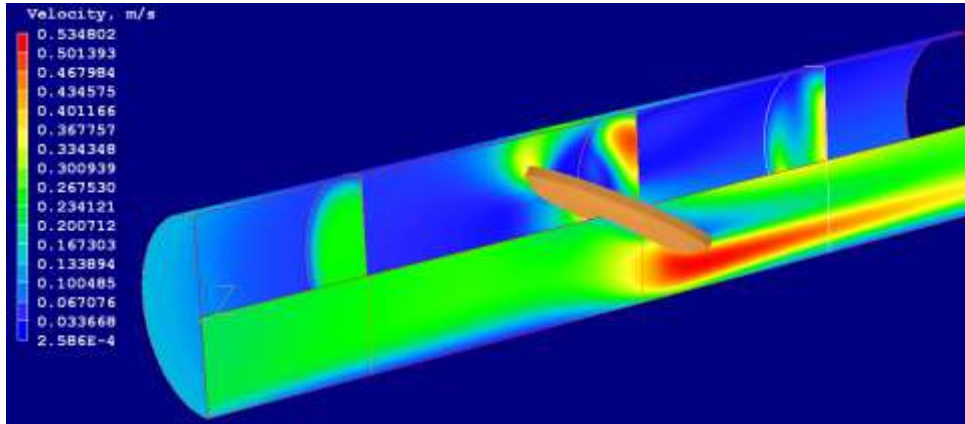
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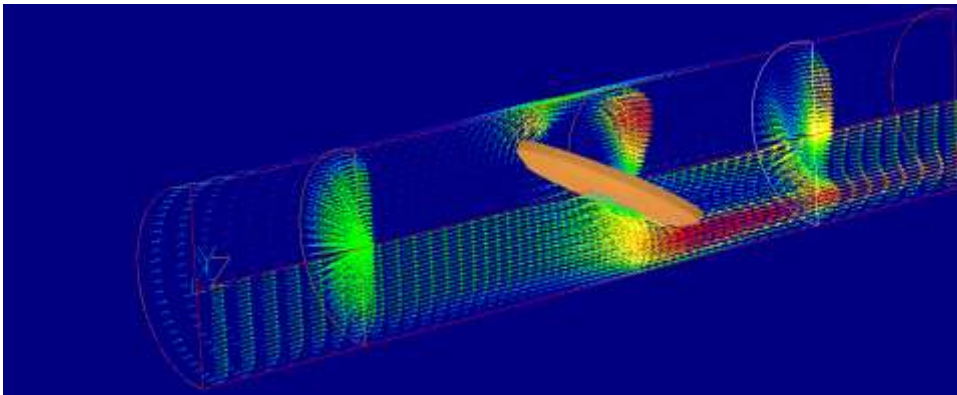
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Velocity contours with a 45° opening in Figure 3 show the incoming stream deflected by the valve.

The highest velocity 0.53 [m/s] at the bottom opening results in jet flow and fluids through the top gap spreading along the whole pipe section, as expected.



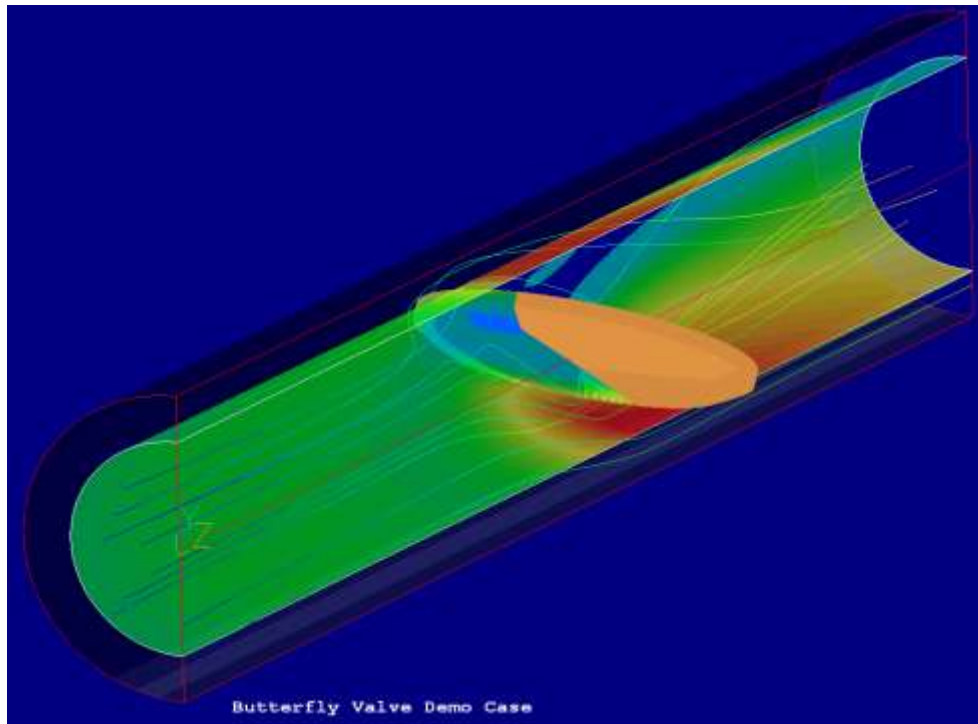
Streamlines of residence time in Figure 4 show the same flow pattern.



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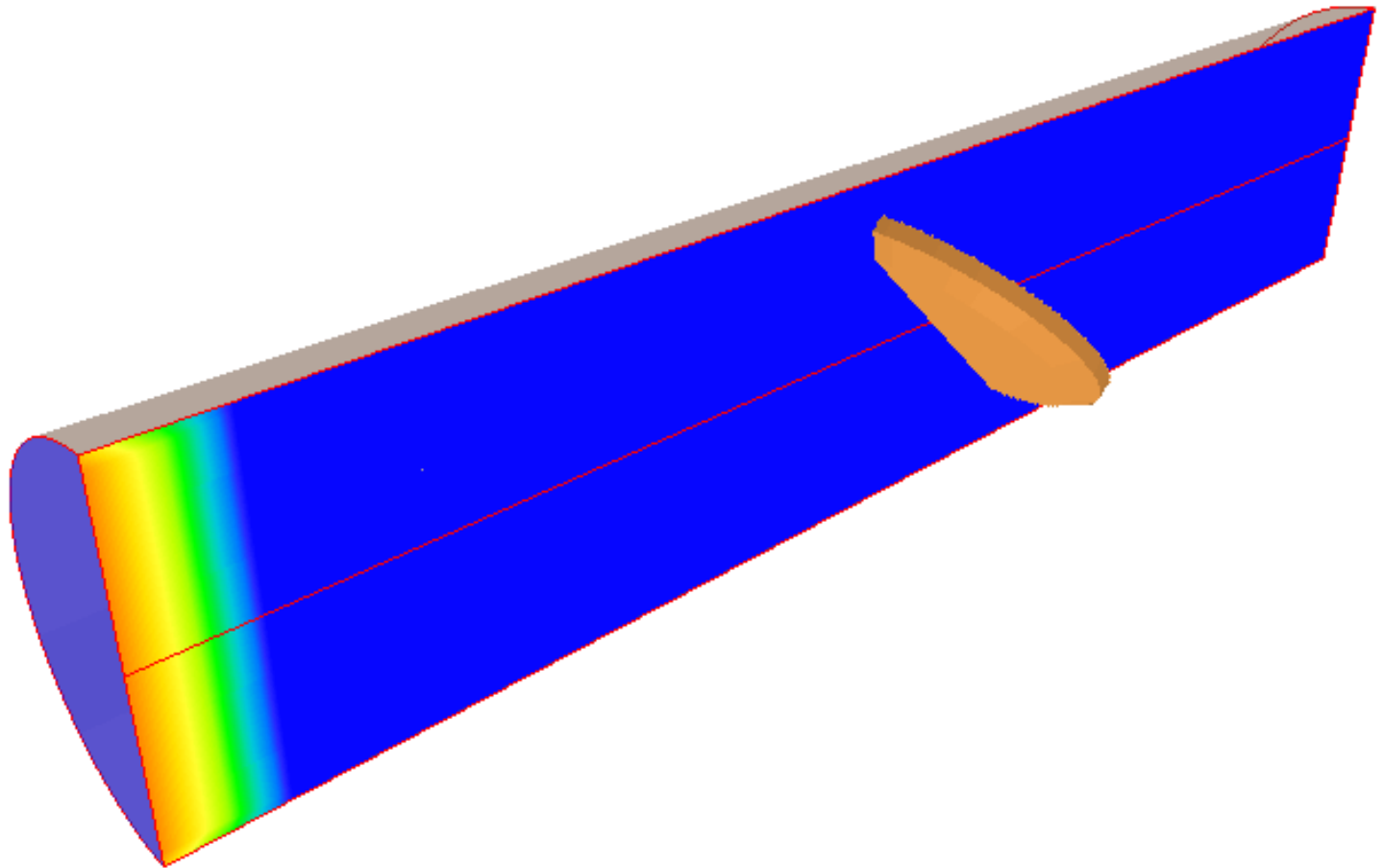
The simulation demonstrates that the POLAR PARSOL feature is a useful tool for valve designers to predict the valve performance to achieve optimal design, and allows control engineers to analyse and improve the behaviour of valves under differing operational circumstances.

Streamlines of residence time at
45° valve opening



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