Abstract

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A Study of Turbulence Induced Forces Acting on a Globe Control Valve Operating at Small Opening.

Under certain opening conditions and partial opening of control valves, the piping systems occasionally suffer large vibrations. To understand the valve instability that is responsible for such vibrations, experiments and CFD simulations were performed. As a result of the study of the turbulence flow through a single seat globe valve operating at small openings, it was found that a complex three-dimensional flow structure (valve attached flow) sets up in the valve region leading to high pressure variations in the valve trim region. CFD calculations showed how a jet may impinge on the roof of the valve body and cause a large-scale recirculation region in the pipe downstream of the valve. Moreover, it was found that the smaller valve opening, the larger the exciting force acting on the valve stem. The harmful effect of the fluid flow forces (exciting forces) is very much pronounced at relatively smaller valve opening. The simulation results for turbulent flow with k-Ï‰ model were more accurate than the k-Îµ model. In addition, k-Ï‰ model was simpler and faster in convergence than the k-Îµ model.