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Design and Optimization of Flow Field for Cavitation Reduction of Valve Sleeves

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Abstract : This paper aims to improve the streamline linked with the flow field and cavitation on the valve sleeve. We observed that local pressure fluctuation produces a low-pressure zone, central to the formation of vapor volume fraction within the valve chamber led to air-bubbles (or cavities). Thus, it allows simultaneously to a severe negative impact on the inner surface and lifespan of the valve sleeves. Cavitation reduction is a vitally important issue to pressure control valves. The optimization of the flow field is proposed in this paper to reduce the cavitation of valve sleeves. In this method, the inner wall of the valve sleeve is changed from a cylindrical surface to the conical surface, leading to the decline of the fluid flow velocity and the rise of the outlet pressure. Besides, the streamline is distributed inside the sleeve uniformly. Thus, the bubble generation is lessened. The fluid models are built and analysis of flow field distribution, pressure, vapor volume and velocity was carried out using computational fluid dynamics (CFD) and numerical technique. The results indicate that this structure can suppress the cavitation of valve sleeves effectively.

Keywords : streamline, cavitation, optimization, computational fluid dynamics
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