عنوان مقاله:

Numerical Analysis on Pipeline Leakage Characteristics for Incompressible Flow

محل انتشار:

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خلاصه مقاله:

Systematic Computational Fluid Dynamics (CFD) simulations on incompressible water pipe flow with leakage were conducted in the present study. The aim is to provide the understanding of how different parameters, including the leakage pipe diameter, inlet mass flow rate, and main pipe length, affect the flow phenomena at the vicinity of the leakage location. The present CFD data show that the leakage pipe diameter has dominant effect on the leak mass quantity, pressure change at the vicinity of leak location, total pressure drop and pressure gradient along the main pipe. The effects of both inlet mass flow rate and the main pipe length on leak mass quantity are comparably important. Due to existence of the leakage pipe, larger velocity but lower pressure at upstream, and lower velocity but larger pressure at downstream occur at the vicinity of leakage, which causes adverse pressure at this region. The pressure change resulted from the adverse pressure increases approximately linear with the leak size ratio (ratio of leakage pipe diameter to main pipe diameter) when it is smaller than approximately ۴۰%, at which the maximum pressure change at the leak location occurs. When the leak size ratio is smaller than approximately ۵%, the pressure change at the leak location is seen to be approximately zero, implying negligible pressure difference at the two boundary points of leakage pipe. There is sudden change in the pressure gradient along the flow direction at the leak location, which results from a local pressure increase there. When farther away from the leakage, the magnitude of the maximum pressure gradient along the flow direction is reduced due to attenuation of leakage effect. The present study proves that CFD analysis could be an effective and less-costly way to investigate pipe flow with leakage, so as to provide scientific understanding of the physics on pipe flows with leakage.

کلمات کلیدی:

Incompressible flow, Pipeline with leakage, Numerical analysis, Leakage characteristics

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