Influence of the Upstream Linear Surges on Energy Characteristics of the Pump as Turbine based on Entropy Production Theory

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In recent years, the utilization of the pumps as turbines (PAT) has been proven to be a feasible alternative for making good use of the flooding and residual water in the abundant water season. While the upstream surges will impact the energy characteristics of the PAT system. In order to investigate the influence of different linear surges on the energy loss variation of PAT system, the entropy production method is utilized to visualize the high energy loss region of the whole pump unit. In this study, the volume of fluid (VOF) model is applied to track the free surface of the upstream and downstream reservoirs, trying to make the simulation more realistic. Results show that the simulated external characteristic curves in pump and turbine mode are in good accordance with the experimental data. The amplitudes of the linear surges impact the distribution of the vorticity and entropy production rate under turbine condition. Therefore, the total energy loss in the whole simulated domain varies with amplitudes of the linear surges. In addition, the pressure pulsation amplitude increases with the linear surge’s amplitude. The results can be referred for the safe and stable operation of the pump stations under power generation condition.