Prediction of flow-induced noise in centrifugal pumps based on a combined CFD/CA method

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Abstract Based on Lighthill equation theory, a hybrid algorithm combining computational fluid mechanics with computational acoustic was adopted to calculate the sound field. The three-dimensional unsteady flow of centrifugal pumps was numerically calculated based on Reynolds-averaged equations closed by SST *k-ω* turbulence model. Acoustic boundary element method was adopted to solve the acoustic radiation of dipole source caused by blade and volute surface pressure. Vibro-acoustic interaction effect on simulation results was analysed and flow induced noise test rig of centrifugal pumps was built to verify the calculation results. The results show that blade passing frequency and its multiple are the main frequency of the flow-induced noise. It would be improper to ignore the vibro-acoustic interaction influence in sound field simulation especially at mode frequency. Sound pressure level at pump outlet displays largest at blade pass frequency and least at maximum efficiency point. Simulation value tallies with the test in the trend, minimum difference of 2.1dB, which is validated the forecast function of numerical simulation.