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INVESTIGATION OF THE NOZZLES' SPACING IMPACT ON THE INTERFERENCE OF UNEQUAL PARALLEL ROUND JETS: LARGE EDDY SIMULATION STUDY

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ABSTRACT

Twin parallel jets contain extensive range of industrial applications such as cooling systems and fuel injection systems. Entrainment of the ambient fluid into the jets' core is the key observation in majority of the applications which yields to raise in mixing owing to the larger momentum transfer. Despite several experimental and numerical studies in literature on twin planar jets, there have been small portion of numerical investigations devoted to the unequal parallel round jets. This paper aims to survey the effect of the jets' distance on the flow features of unequal round jets by large eddy simulation (LES) utilizing OpenFOAM package. The Reynolds numbers (*Re*) of unequal jets for all cases are set to 10,000 and 5,000 based on their same diameters and different jets' velocities. To analyze the effect of the distance between unequal twinjets, three spacings $S/D_{jet}= 1.1, 1.5$ and 2 are considered. The LES results for a similar mesh quality including a single jet with the *Re* of 5,000 are evaluated by the available experimental data. The validation of current LES study proved well enough match in terms of radial and axial distributions of mean and r.m.s velocity profiles. In addition, to track the flow structures and jets' interference properly versus jet-spacing, two different passive scalars are ejected from left and right jets. The mean streamwise velocity profiles for three cases demonstrated that, near the jets' exit section, there is huge difference between the profiles and distant jets (for instance $S/D_{jet}=2$) act independently. Getting away from jets exit, due to the interaction of two jets the velocity profiles for three cases become similar (~ 9D far from jet exit) with the asymmetrical bell shape. In addition, the maximum points position of jets' velocity profiles (for both left and right) remain almost constant as moving toward downstream in all cases. The mean concentration contours for strong and weak jets proved that the strong jet is not affected by the weak one even for very close vicinity jets (small distance). A remarkable observation is that the position of maximum point of weak jet's passive scalar is moving outward direction as getting far from the jets exit. Whereas, as the jets' distance increases the weak jet will be entrained strongly toward the strong jet. In addition, as the distance between the jets reduces, the strong jet pushes away the maximum point of the weak jet's passive scalar more intensely.