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Control of jet entrainment and diffusion by modification of initial velocity distribution

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Abstract

The control of the entrainment and diffusion of the heat and mass ejected along the jet flow requires the control of fluid motion. In the present study, optimal initial velocity distributions for suppressing and promoting jet entrainment and diffusion were identified using deep reinforcement learning under constant initial jet flow rate conditions. Two-dimensional jet flow simulations were combined with a deep reinforcement learning. Figure 1 shows the cross-streamwise distributions of initial velocity for the cases aimed at maximizing and minimizing the downstream flowrate. The results show that to suppress the entrainment of the jet, an optimal initial velocity distribution shape in which the velocity in the center is small, and an outward velocity, is desirable. However, to promote entrainment, a shape with a large velocity in the center portion and small velocity at the outer edge, with an overall inward angle, is desirable. It was also found that optimization with ejection angle components can significantly improve the results for cases related to suppression of entrainment. However, the ejection angle component does not have a significant impact on optimization cases related to entrainment promotion.

Keywords: Jet control, entrainment, diffusion

Figure 1. Cross-streamwise distributions of initial velocity for the cases aimed at minimizing (left) and maximizing (right) the downstream flowrate.