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The Effect of Bottom Shape and Baffle Length on the Flow Field in Stirred Tanks in Turbulent and Transitional Flow

Authors : Jie Dong, Binjie Hu, Andrzej W Pacek, Xiaogang Yang, Nicholas J. Miles

Abstract : The effect of the shape of the vessel bottom and the length of baffles on the velocity distributions in a turbulent and in a transitional flow has been simulated. The turbulent flow was simulated using standard k-ε model and simulation was verified using LES whereas transitional flow was simulated using only LES. It has been found that both the shape of tank bottom and the baffles’ length has significant effect on the flow pattern and velocity distribution below the impeller. In the dished bottom tank with baffles reaching the edge of the dish, the large rotating volume of liquid was formed below the impeller. Liquid in this rotating region was not fully mixing. A dead zone was formed here. The size and the intensity of circulation within this zone calculated by k-ε model and LES were practically identical what reinforces the accuracy of the numerical simulations. Both types of simulations also show that employing full-length baffles can reduce the size of dead zone formed below the impeller. The LES was also used to simulate the velocity distribution below the impeller in transitional flow and it has been found that secondary circulation loops were formed near the tank bottom in all investigated geometries. However, in this case the length of baffles has smaller effect on the volume of rotating liquid than in the turbulent flow.

Keywords : baffles length, dished bottom, dead zone, flow field
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