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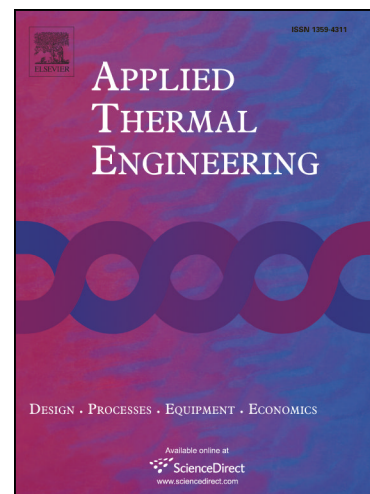
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A brief review on the buoyancy criteria for supercritical fluids

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Highlights

A brief review on the buoyancy criteria for supercritical fluids was conducted. Several buoyancy criteria proposed in the literatures were assessed and compared. Inconsistencies between the predictions and data were emphasized and evaluated. The most reliable buoyancy criteria were recommended.

Abstract

This study presents a brief review on the buoyancy criteria for supercritical fluids (mainly water, carbon dioxide and hydrocarbon fuels). Buoyancy affected heat transfer at supercritical pressures is an important phenomenon. However, the effect of buoyancy force of supercritical fluids was not properly addressed in some earlier studies. Some researchers believed that the neglect of buoyancy was the primary reason for the considerable disagreement between predictions by the available empirical correlations and experimental data. In this paper, several common buoyancy criteria proposed in the literatures to distinguish forced convection and mixed convection were assessed and compared. Inconsistencies were observed, e.g., the buoyancy parameter might be the same, but the threshold to affect the heat transfer in the correlation is different. Comparisons between the predictions and the experimental or numerical data were given and the discrepancies were emphasized and evaluated. The most reliable buoyancy criteria for vertical and horizontal tubes were recommended. However, no one buoyancy criterion can accurately predict the magnitude and onset of buoyancy force for different kinds of supercritical fluids, therefore further research is still needed.

Keywords: buoyancy criteria; heat transfer; supercritical fluids; buoyancy effect

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