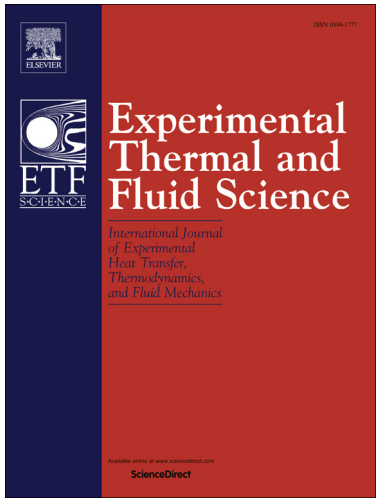

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Quantitative visualization of temperature field and measurement of local heat transfer coefficient over heat exchanger elements in sinusoidal oscillating flow

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Abstract

The flow and heat transfer in the near field of simplified heat exchanger elements (two cylinders in a tandem arrangement and a longitudinal finned tube) immersed in oscillatory flow were experimentally investigated. The effects of cylinder spacing on heat transfer in the tandem arrangement were examined. The ambient flow was a sinusoidal planar oscillating flow. A synchronous PIV-PLIF (Particle Image Velocimetry- Planar Laser Induced Fluorescence) technique was used to simultaneously capture the time-dependent velocity and temperature fields. In the tandem cylinder configuration, a higher temperature drop in the gap region between the cylinders was observed for the larger cylinder spacing, which yielded to a higher heat transfer rate. For the finned tube configuration, both the velocity and temperature fields featured two recirculation zones at the bases of the attached longitudinal fins. These recirculation bubbles contained flow particles with low velocity and high temperature which led to a lower heat transfer rate in these zones. The heat transfer characteristics of heat exchanger elements in oscillating flows were found to be significantly different from those in steady flows. The results were compared to the heat transfer from a single circular cylinder under identical conditions.

Keywords: *Quantitative visualization, local heat transfer coefficient, oscillatory flow, tandem cylinders, finned tube*.