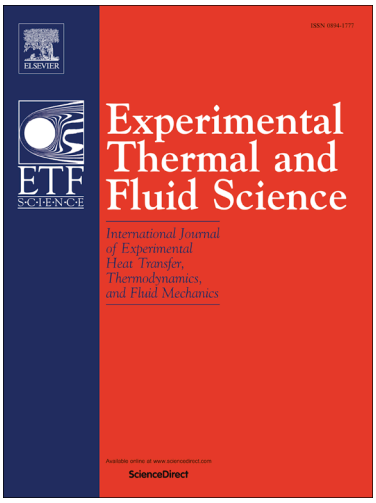

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Temperature Field Measurements of Thermal Boundary Layer and Wake of Moving Hot Spheres using Interferometry

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Abstract

The methodology used to post-process a raw interferogram of a hot moving sphere falling in an inert nitrogen environment is presented. The steps taken to obtain the temperature field around the hot sphere are explained in detail. These are: (i) noise removal; (ii) phase demodulation; (iii) phase unwrapping; (iv) bias removal; and (v) Abel transform. All the typical features of the flow are revealed such as growth of the thermal boundary layer, shallower temperature gradients were the flow separates, and a hot wake in the recirculation zone. For validation of the methodology, the temperature field is compared against numerical simulations and found to be in excellent qualitative and quantitative agreement all around except at the front and rear stagnation points. The difficulties encountered with resolving these regions are discussed. Overall, interferometry is found to be an excellent tool for resolving thermal flows, including thin regions, such as thermal boundary layers.

Keywords: Thermal boundary layer, Sphere, Interferometry

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