

II Abstract

The main purpose of the investigation detailed here was to determine whether or not oil film interferometry techniques could be applied to impinging sonic and supersonic flows. Experimentation was limited to the flow fields generated by impinging jets emanating from convergent nozzles with square and rectangular cross sections. The impingement plate was coated with polished aluminium sheeting to provide the required reflective surface. Interferometry images were generated by the application of Dow Corning PMX 200 silicone fluid to the plate, which was illuminated by a monochromatic sodium light source. Images were captured using a Nikon D90 DSLR camera with a standard 18-55mm lens. The shear force at various points on the plate was determined by analysing the resultant images using the MATLAB image processing toolbox. The experimental results were then compared to results from CFD simulations that were carried out using the Fluent components of ANSYS v.13. A quantitative examination of the two sets of results revealed that the experimental results were consistently lower than the shear forces predicted by CFD simulations, particularly in the high shear areas near the centre of impingement. However, a qualitative examination of the interferometry images showed interesting results. These images gave a good representation of the overall flow patterns over the plate, with clearly defined fringe patterns visible in the oil coating. Therefore the investigation discussed here was determined to be a successful proof of concept for the utilisation of oil film interferometry techniques in this application. It is believed that the methodology utilised in this investigation can be successfully developed to significantly improve the accuracy of the quantitative results.