ACOUSTICS2008/1145
Advanced flow measurements in thermoacoustic systems

Arganthaël Berson and Philippe Blanc-Benon
Ecole Centrale de Lyon, LMFA, UMR CNRS 5509, Ecully, 69134 Lyon, France

One of the bottlenecks for the conception of highly efficient thermoacoustic systems is the poor performances of heat exchangers. A better understanding of both aerodynamical and thermal phenomena that occur at the interface between the stack and the heat exchangers is necessary for the improvement of heat transport between these components, especially at high acoustic amplitudes that are required for industrial applications. To this end, a specific Particle Image Velocimetry (PIV) method has been developed and measurements are performed within a standing-wave thermoacoustic refrigerator model driven at high drive ratios (up to 5%). Vortex streets are observed behind the plates of a single stack at high acoustic level. The flow is characterized using advanced vortex analysis tools and dimensionless numbers. Vortices also appear within the gap between the stack and the heat exchangers. They will influence heat transport as was previously shown in numerical simulations from the literature. Moreover, as a first step toward enthalpy flux measurements, cold and hot wire anemometry methods are developed specifically for temperature and velocity measurements in oscillating flows. First results with these techniques will be presented and compared to available numerical and analytical models. This work is supported by ANR (project MicroThermAc NT051_42101).