

# Optical Characterisation of Surface and Interface Waves in Liquid Metal-Water Layers Using PIV and Laser Vibrometer Techniques

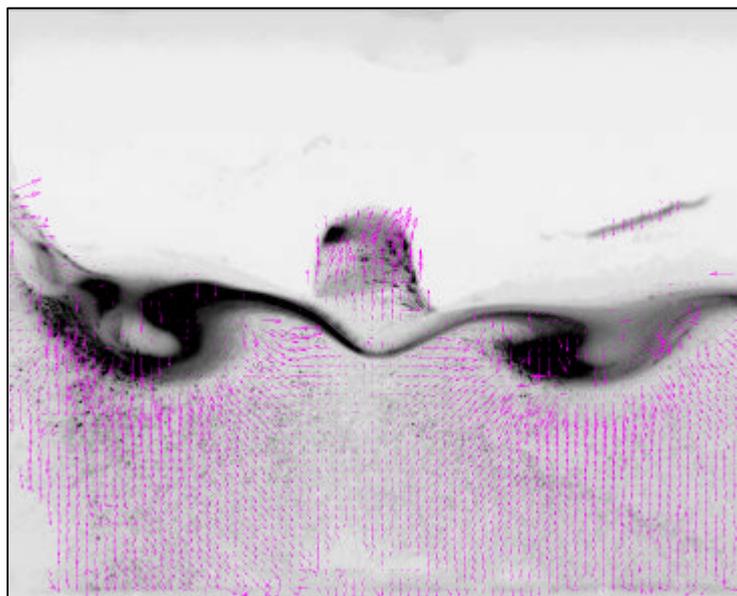
by

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## ABSTRACT

Particle Image Velocimetry (PIV) and Laser Vibrometer techniques have been used to investigate interface waves in a fluid system under the influence of gravity waves. In a cylindrical or rectangular glass test cell are two layers of fluids: water and a liquid metal at room temperature (Ga-In-Sn alloy). The PIV method is used to determine the flow field within the transparent fluid and the deformation of the boundary layer between the two fluids. The interface waves in the fluid system has been stimulated by a shaker in a frequency range of 3-30 Hz . The resonant frequencies of the interfacial oscillations are measured with a single point laser vibrometer for different cell geometry and different heights of the water layer. The velocity vector plots in the water layer show different modes and orientations of the interfacial waves. From this vector plots horizontal and vertical velocity profiles are calculated to indicate instabilities and to compare the experimental results with numerical simulations. The measurement of the resonant frequencies shows an influence of the height of the water layer in the case of the cylindrical cell: the frequency of the basic modes increases with increasing water layer depth. In the rectangular cell a more complicated mode structure were observed. The optical characterisation of the interface layer and the flow field in the transparent fluid are this first steps in order to get a physical model of the nature of gravity waves in technical systems like the aluminium reduction cell. The efficient non-invasive methods PIV and Laser Vibrometer are applied in a new field of measurement techniques: the detection of interfaces waves in liquids.



*Fig. 1. Unstable non-linear interface deformation in the system water-air*